



**VA**

**U.S. Department  
of Veterans Affairs**

Department of Veterans Affairs  
Office of Construction & Facilities Management

Manhattan Veteran's Affairs Medical Center  
Manhattan VAMC Bldg. 1 - 9th Floor Renovations  
New York, New York

Manhattan VAMC Bldg. 1 - 9th Floor Renovations

Contract Document Submission  
Project Manual

**BID SET**

August 15, 2013

**CANNONDESIGN**

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Manhattan VAMC Bldg. 1 - 9th Floor Renovations  
Manhattan Veteran's Affairs Medical Center  
New York, New York

DEPARTMENT OF VETERANS AFFAIRS  
VHA MASTER SPECIFICATIONS

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**SECTION 00 01 15  
LIST OF DRAWINGS**

The drawings listed below accompanying this specification form a part of the contract.

Drawing No.	Title
<b>GENERAL PROJECT</b>	
1-G0001	Drawing Index
1-G0002	Architectural Notes, Symbols & Abbreviations
1-G0003	Typical Mounting Heights
<b>LIFE SAFETY</b>	
1-G0109	Life Safety Plan - 9 <sup>th</sup> Floor
1-G109-N	Enlarged Life Safety Plan 9 <sup>th</sup> Floor - North
1-G109-S	Enlarged Life Safety Plan 9 <sup>th</sup> Floor - South
1-G109-W	Enlarged Life Safety Plan 9 <sup>th</sup> Floor - West
1-G0110	Enlarged Life Safety Plan Partial 10 <sup>th</sup> Floor
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1-AD209	Overall Architectural Demolition Plan - 9 <sup>th</sup> Floor
1-AD209-N	Enlarged Demolition Plan 9 <sup>th</sup> Floor - North
1-AD209-S	Enlarged Demolition Plan 9 <sup>th</sup> Floor - South
1-AD209-W	Enlarged Demolition Plan 9 <sup>th</sup> Floor - West
1-AD210	Enlarged Demolition Plans - 10 <sup>th</sup> & 19 <sup>th</sup> Floors
1-HA001	Asbestos Abatement Plan - Partial 10 <sup>th</sup> Floor
1-HA002	Asbestos Abatement Plan 8 <sup>th</sup> Floor - South
<b>FLOOR PLAN</b>	
1-AE109	Overall Architectural Plan - 9 <sup>th</sup> Floor
1-AE109-N	Enlarged Plan 9 <sup>th</sup> Floor - North
1-AE109-S	Enlarged Plan 9 <sup>th</sup> Floor - South
1-AE109-W	Enlarged Plan 9 <sup>th</sup> Floor - West
1-AE110	Enlarged Partial Plans - 10 <sup>th</sup> & 19 <sup>th</sup> Floors
1-AR109	Overall Reflected Ceiling Plan - 9 <sup>th</sup> Floor
1-AR109-N	Enlarged Reflected Ceiling Plan 9 <sup>th</sup> Floor - North
1-AR109-S	Enlarged Reflected Ceiling Plan 9 <sup>th</sup> Floor - South

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1-AR109-W	Enlarged Reflected Ceiling Plan 9 <sup>th</sup> Floor - West
1-AQ109	Overall Furniture & Equipment Plan - 9 <sup>th</sup> Floor
1-AQ109-N	Enlarged Furniture & Equipment Plan 9 <sup>th</sup> Floor - North
1-AQ109-S	Enlarged Furniture & Equipment Plan 9 <sup>th</sup> Floor - South
1-AQ109-W	Enlarged Furniture & Equipment Plan 9 <sup>th</sup> Floor - West

**SCHEDULES**

1-AE-601	Partition Schedule
1-AE-602	Door Frames, Elevations and Details
1-AE-603	Door Schedule
1-AE-604	Door Schedule

**FINISH PLANS**

1-AF001	Finish Legend
1-AF002	Room Finish Schedule Rooms 9000C - 9087S
1-AF003	Room Finish Schedule Rooms 9088S - 9190N
1-AF109	Overall Finish Plan - 9 <sup>th</sup> Floor
1-AF109-N	Enlarged Finish Plan 9 <sup>th</sup> Floor - North
1-AF109-S	Enlarged Finish Plan 9 <sup>th</sup> Floor - South
1-AF109-W	Enlarged Finish Plan 9 <sup>th</sup> Floor - West

**WAYFINDING**

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1-AG100	Wayfinding Message Schedule
1-AG101	Wayfinding Message Schedule
1-AG109	Overall Wayfinding Plan - 9 <sup>th</sup> Floor
1-AG109-N	Enlarged Wayfinding Plan 9 <sup>th</sup> Floor - North
1-AG109-S	Enlarged Wayfinding Plan 9 <sup>th</sup> Floor - South
1-AG109-W	Enlarged Wayfinding Plan 9 <sup>th</sup> Floor - West
1-AG110	Enlarged Wayfinding Plan - Partial 10 <sup>th</sup> Floor
1-AG201	Wayfinding Interior Signage Elevations and Details
1-AG202	Wayfinding Interior Signage Elevations and Details



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1-AI403	Enlarged Interior Partial Plans and Elevations
1-AI404	Enlarged Interior Partial Plans and Elevations
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1-AI502	Interior Details
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**MECHANICAL DRAWINGS**

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1-MD209-N	Mechanical Demolition Plan 9 <sup>th</sup> Floor - North
1-MD209-S	Mechanical Demolition Plan 9 <sup>th</sup> Floor - South
1-MD209-W	Mechanical Demolition Plan 9 <sup>th</sup> Floor - West
1-MD210	Mechanical Demolition Plan Partial - 10 <sup>th</sup> Floor
1-MH001	Mechanical Notes Symbols & Abbreviations
1-MH002	Mechanical Symbols
1-MH109	Mechanical AHU Zoning Plan 9 <sup>th</sup> Floor
1-MH109-N	Mechanical Ductwork Plan 9 <sup>th</sup> Floor - North
1-MH109-S	Mechanical Ductwork Plan 9 <sup>th</sup> Floor - South
1-MH109-W	Mechanical Ductwork Plan 9 <sup>th</sup> Floor - West
1-MP109-N	Mechanical Piping Plan 9 <sup>th</sup> Floor - North
1-MP109-S	Mechanical Piping Plan 9 <sup>th</sup> Floor - South
1-MP109-W	Mechanical Piping Plan 9 <sup>th</sup> Floor - West

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1-MH503	Mechanical Details 3
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1-MH505	Mechanical Details 5
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1-MH701	Mechanical Riser Diagram
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**FIRE ALARM**

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1-FA109-N	Fire Alarm Plan 9 <sup>th</sup> Floor - North
1-FA109-S	Fire Alarm Plan 9 <sup>th</sup> Floor - South
1-FA109-W	Fire Alarm Plan 9 <sup>th</sup> Floor - West
1-FA110	Fire Alarm Plan - Partial 10 <sup>th</sup> Floor
1-FA601	Fire Alarm Riser Diagram

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1-E0001	Electrical Symbols, Notes and Abbreviations
1-ED208-N	Electrical Demolition Plan 8 <sup>th</sup> Floor - North
1-ED208-S	Electrical Demolition Plan 8 <sup>th</sup> Floor - South
1-ED208-W	Electrical Demolition Plan 8 <sup>th</sup> Floor - West
1-ED209-N	Electrical Demolition Plan 9 <sup>th</sup> Floor - North
1-ED210	Electrical Demolition Plans - Partial 10 <sup>th</sup> and 19 <sup>th</sup> Floors
1-EL209-N	Electrical Lighting Plan 9 <sup>th</sup> Floor - North
1-EL209-S	Electrical Lighting Plan 9 <sup>th</sup> Floor - South
1-EL209-W	Electrical Lighting Plan 9 <sup>th</sup> Floor - West
1-EL601	Luminaire Schedule and Details
1-EP109-N	Electrical Power Plan 9 <sup>th</sup> Floor - North
1-EP109-S	Electrical Power Plan 9 <sup>th</sup> Floor - South
1-EP109-W	Electrical Power Plan 9 <sup>th</sup> Floor - West
1-EP401	Electrical Enlarged Plans
1-EP501	Electrical Power Riser Diagram
1-EP601	Electrical Schedules Sheet No.1

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1-EP602	Electrical Schedules Sheet No.2
1-EP603	Electrical Schedules Sheet No.3

**TELECOMMUNICATIONS**

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1-TA0109-S	Audio/Visual Plan - 9 <sup>th</sup> Floor - South
1-TA0109-W	Audio/Visual Plan - 9 <sup>th</sup> Floor - West
1-TA0501	Audio/Visual Details
1-TM0109-N	Nurse Call Plan - 9 <sup>th</sup> Floor - North
1-TM0109-S	Nurse Call Plan - 9 <sup>th</sup> Floor - South
1-TM0109-W	Nurse Call Plan - 9 <sup>th</sup> Floor - West
1-TM0501	Nurse Call Details
1-TN0101-W	Telecommunications Plan - 1 <sup>st</sup> Floor - West
1-TN0102-S	Telecommunications Plan - 2 <sup>nd</sup> Floor - South
1-TN0109-N	Telecommunications Plan - 9 <sup>th</sup> Floor - North
1-TN0109-S	Telecommunications Plan - 9 <sup>th</sup> Floor - South
1-TN0109-W	Telecommunications Plan - 9 <sup>th</sup> Floor - West
1-TN0110-C	Telecommunications Plan - 10 <sup>th</sup> Floor
1-TN0401	Telecommunications Enlarged Plan
1-TN0501	Telecommunications Details
1-TN0502	Optical Fiber Backbone Distribution Riser
1-TN0503	Copper Backbone Distribution Riser
1-TY0101-W	Security Plan - 1 <sup>st</sup> Floor - West
1-TY0109-N	Security Plan - 9 <sup>th</sup> Floor - North
1-TY0109-S	Security Plan - 9 <sup>th</sup> Floor - South
1-TY0109-W	Security Plan - 9 <sup>th</sup> Floor - West
1-TY0110-C	Security Plan - 10 <sup>th</sup> Floor
1-TY0401	Security Enlarged Plans
1-TY0501	Security Details

**PLUMBING DRAWINGS**

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1-PD208-N	Plumbing Demolition Plan 8 <sup>th</sup> Floor - North
1-PD208-S	Plumbing Demolition Plan 8 <sup>th</sup> Floor - South
1-PD208-W	Plumbing Demolition Plan 8 <sup>th</sup> Floor - West
1-PD209-N	Plumbing Demolition Plan 9 <sup>th</sup> Floor - North
1-PD209-S	Plumbing Demolition Plan 9 <sup>th</sup> Floor - South
1-PD209-W	Plumbing Demolition Plan 9 <sup>th</sup> Floor - West

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1-PP108-N	Plumbing Supply Plan 8 <sup>th</sup> Floor - North
1-PP108-S	Plumbing Supply Plan 8 <sup>th</sup> Floor - South
1-PP108-W	Plumbing Supply Plan 8 <sup>th</sup> Floor - West
1-PP109-N	Plumbing Supply Plan 9 <sup>th</sup> Floor - North
1-PP109-S	Plumbing Supply Plan 9 <sup>th</sup> Floor - South
1-PP109-W	Plumbing Supply Plan 9 <sup>th</sup> Floor - West
1-PP601	Plumbing Supply Riser Diagrams
1-PP602	Plumbing Supply Riser Diagrams
1-PP603	Plumbing Supply Riser Diagrams
1-PL108-N	Plumbing Sanitary Plan 8 <sup>th</sup> Floor - North
1-PL108-S	Plumbing Sanitary Plan 8 <sup>th</sup> Floor - South
1-PL108-W	Plumbing Sanitary Plan 8 <sup>th</sup> Floor - West
1-PL109-N	Plumbing Sanitary Plan 9 <sup>th</sup> Floor - North
1-PL109-S	Plumbing Sanitary Plan 9 <sup>th</sup> Floor - South
1-PL109-W	Plumbing Sanitary Plan 9 <sup>th</sup> Floor - West
1-PL401	Enlarged Plumbing Plans - Partial 10 <sup>th</sup> Floor
1-PL601	Plumbing Sanitary Riser Diagrams
1-PL602	Plumbing Sanitary Riser Diagrams
1-PL603	Plumbing Sanitary Riser Diagrams

**FIRE PROTECTION**

1-FX001	Fire Protection General Notes, Symbols, Abbreviations and Details
1-FD209-N	Fire Protection Demolition Plan 9 <sup>th</sup> Floor - North
1-FD209-S	Fire Protection Demolition Plan 9 <sup>th</sup> Floor - South
1-FD209-W	Fire Protection Demolition Plan 9 <sup>th</sup> Floor - West
1-FX108-N	Fire Protection Plan 8 <sup>th</sup> Floor - North
1-FX109-N	Fire Protection Plan 9 <sup>th</sup> Floor - North
1-FX109-S	Fire Protection Plan 9 <sup>th</sup> Floor - South
1-FX109-W	Fire Protection Plan 9 <sup>th</sup> Floor - West
1-FX110-N	Fire Protection Plan 10 <sup>th</sup> Floor - North
1-FX601	Fire Protection Riser Diagram

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# DEPARTMENT OF VETERANS AFFAIRS



## OFFICE OF CONSTRUCTION & FACILITIES MANAGEMENT

### EASTERN REGION OFFICE

8380 COLESVILLE ROAD, SUITE 420

SILVER SPRING, MD 20410

Manhattan Campus of the VA NY Harbor Healthcare System



## RENOVATION OF THE 9<sup>TH</sup> FLOOR OF BUILDING 1

Request for Proposal VA101-13-R-0145

Project Number 630-600

**SENIOR CONTRACTING OFFICER**

**Ed Nicholson**

**Tel: (301) 427-2174**

**CONTRACTING OFFICER TECHNICAL REPRESENTATIVE (COR)**

**Troy Waller, Project Manager**

**Tel: (301) 427-2066**

**ISSUED DATE**

**August 16, 2013**

**PRE-PROPOSAL CONFERENCE**

**September 4, 2013**

**RFP DUE DATE**

**September 16, 2013**

<b>SOLICITATION, OFFER AND AWARD (Construction, Alteration, or Repair)</b>		1. SOLICITATION NO.  VA101-13-R-0145	2. TYPE OF SOLICITATION <input type="checkbox"/> SEALED BID (IFB) <input checked="" type="checkbox"/> NEGOTIATED (RFP)	3. DATE ISSUED  08-16-2013	PAGE OF PAGES  1 of 80
<b>IMPORTANT - The "offer" section on the reverse must be fully completed by offeror.</b>					
4. CONTRACT NO.  CODE		5. REQUISITION/PURCHASE REQUEST NO.		6. PROJECT NO.  630-600	
7. ISSUED BY  Dept of Veterans Affairs, Office of Construction and Facilities Management Eastern Region Office (003C4C) 8380 Colesville Road, Suite 420 Silver Spring MD 20410		8. ADDRESS OFFER TO  Dept of Veteran Affairs, Office of Construction and Facilities Management Eastern Region Office (003C4C) 8380 Colesville Road, Suite 420 Silver Spring MD 20410			
9. FOR INFORMATION CALL:		A. NAME ED NICHOLSON		B. TELEPHONE NO. (Include area code) (NO COLLECT CALLS) 301-427-2174	

#### SOLICITATION

**NOTE:** In sealed bid solicitations "offer" and "offeror" mean "bid" and "bidder".

10. THE GOVERNMENT REQUIRES PERFORMANCE OF THE WORK DESCRIBED IN THESE DOCUMENTS (Title, identifying no., date):

Contractor shall furnish labor and materials, equipment, transportation, supervision, coordination and services required to perform and complete the selective demolition, minor asbestos abatement, and the complete renovation and construction on the 9th floor, and minor demolition, construction and asbestos abatement on the 8th and 10th floors of the VA NY Harbor Healthcare System's Manhattan Campus, Building 1 as required by drawings and specifications for Project 630-600, Renovation of the 9th Floor of Building 1 at the Manhattan Campus of the VA NY Harbor Healthcare System, New York, NY.

#### PROPOSAL ITEMS:

CLIN 0001 - BASE BID

The estimated magnitude for the project is between \$10,000,000 and \$20,000,000.

The NAICS code is 236220 with the small business size standard of \$33.5 Million.

This acquisition is being advertised unrestricted.

In accordance with FAR 52.229-3 paragraph (b)(1) "The contract price includes all applicable Federal, State, and local taxes and duties".

All questions are to be submitted by email to ed.nicholson@va.gov by 1:00pm ET on September 5, 2013. Email subject line should state "RFI for Manhattan - VA101-13-R-0145 - [Company Name]".

11. The Contractor shall begin performance within <u>10</u> calendar days and complete it within <u>270</u> calendar days after receiving <input type="checkbox"/> award, <input checked="" type="checkbox"/> notice to proceed. This performance period is <input checked="" type="checkbox"/> mandatory, <input type="checkbox"/> negotiable. (See <u>52.211-10</u> .)	
12A. THE CONTRACTOR MUST FURNISH ANY REQUIRED PERFORMANCE AND PAYMENT BONDS? (If "YES," indicate within how many calendar days after award in Item 12B.)  <input checked="" type="checkbox"/> YES <input type="checkbox"/> NO	12B. CALENDAR DAYS  10
13. ADDITIONAL SOLICITATION REQUIREMENTS: A. Sealed offers in original and <u>5</u> copies to perform the work required are due at the place specified in Item 8 by <u>1:00 PM ET</u> (hour) local time <u>09-16-2013</u> (date). If this is a sealed bid solicitation, offers must be publicly opened at that time. Sealed envelopes containing offers shall be marked to show the offeror's name and address, the solicitation number, the date and time offers are due B. An offer guarantee <input checked="" type="checkbox"/> is, <input type="checkbox"/> is not required. C. All offers are subject to the (1) work requirements, and (2) other provisions and clauses incorporated in the solicitation in full text or by reference D. Offers providing less than <u>120</u> calendar days for Government acceptance after the date offers are due will not be considered and will be rejected.	

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OFFER(Must be fully completed by offeror)

14. NAME AND ADDRESS OF OFFEROR (Include ZIP Code)	15. TELEPHONE NO. (Include area code)
	16. REMITTANCE ADDRESS (Include only if different than Item 14)
CODE FACILITY CODE	

17. The offeror agrees to perform the work required at the prices specified below in strict accordance with the terms of the solicitation, if this offer is accepted by the Government in writing within \_\_\_\_\_ calendar days after the date offers are due. (Insert any number equal to or greater than the minimum requirement stated in Item 13D. Failure to insert any number means the offeror accepts the minimum in Item 13D.)

AMOUNTS	CLIN 0001 - BASE BID _____
---------	----------------------------

18. The offeror agrees to furnish any required performance and payment bonds.

## 19. ACKNOWLEDGMENT OF AMENDMENTS

(The offeror acknowledges receipt of amendments to the solicitation - give number and date of each)

[illegible]

20A. NAME AND TITLE OF PERSON AUTHORIZED TO SIGN OFFER (Type or print)	20B. SIGNATURE	20C. OFFER DATE
---	----------------	-----------------

AWARD (To be completed by Government)

21. ITEMS ACCEPTED:

22. AMOUNT	23. ACCOUNTING AND APPROPRIATION DATA
------------	---------------------------------------

24. SUBMIT INVOICES TO ADDRESS SHOWN IN (4 copies unless otherwise specified)	ITEM	25. OTHER THAN FULL AND OPEN COMPETITION PURSUANT TO <input type="checkbox"/> 10 U.S.C. 2304(c) ( ) <input type="checkbox"/> 41 U.S.C. 253(c) ( ) <input type="checkbox"/>
--	------	---

26. ADMINISTERED BY	CODE	27. PAYMENT WILL BE MADE BY
Dept of Veterans Affairs, Office of Construction and Facilities Management Eastern Region Office (003C4C) 8380 Colesville Road, Suite 420 Silver Spring MD 20410		Department of Veterans Affairs FMS-VA-2(101) Financial Services Center PO Box 149971 Austin TX 78714-9971
		PHONE: FAX:

CONTRACTING OFFICER WILL COMPLETE ITEM 28 OR 29 AS APPLICABLE

<input type="checkbox"/> 28. NEGOTIATED AGREEMENT (Contractor is required to sign this document and return _____ copies to issuing office.) Contractor agrees to furnish and deliver all items or perform all work, requisitions identified on this form and any continuation sheets for the consideration stated in this contract. The rights and obligations of the parties to this contract shall be governed by (a) this contract award, (b) the solicitation, and (c) the clauses, representations, certifications, and specifications incorporated by reference in or attached to this contract.	<input type="checkbox"/> 29. AWARD (Contractor is not required to sign this document.) Your offer on this solicitation, is hereby accepted as to the items listed. This award consummates the contract, which consists of (a) the Government solicitation and your offer, and (b) this contract award. No further contractual document is necessary.
--	--

30A. NAME AND TITLE OF CONTRACTOR OR PERSON AUTHORIZED TO SIGN (Type or print)	31A. NAME OF CONTRACTING OFFICER (Type or print)
--	--

30B. SIGNATURE	30C. DATE	31B. UNITED STATES OF AMERICA	
		BY	



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**PROPOSAL REQUIREMENTS**  
**9<sup>TH</sup> FLOOR OUTPATIENT RENOVATIONS**

VA MEDICAL CENTER  
MANHATTAN, NY  
**PROJECT NO. 630-600**

A. PART I - GENERAL

A1. Scope of Contract

Contractor shall furnish labor and materials, equipment, transportation, supervision, coordination and services required to perform and complete the 9<sup>th</sup> Floor Outpatient Services Renovations, to include minor demolition, construction and asbestos removal on the 8th and 10th floors in support of 9th floor requirements as required by plans and specifications issued with this solicitation. Work shall include specific tasks as further defined by this request for proposal (RFP).

A2. Definitions

A. VA Staff/Functions

1. Contracting Officer: The services to be performed under this contract are subject to the general supervision, direction, control and approval of the Contracting Officer.
2. Project Manager: The Contracting Officer's representative responsible for administering contracts under the immediate direction of the Contracting Officer.
3. Resident Engineer: The Contracting Officer's authorized representative at the construction site. When more than one Resident Engineer is assigned to a construction project one is designated as being in-charge and is called the "Senior Resident Engineer". The Resident Engineer is responsible for protecting the Government's interest in the execution of the construction contract work. His duties include surveillance of all construction work to assure compliance with the contract documents, interpretation of the contract documents, approval of changed work, approval of all submittals, samples, shop drawings, etc. The Resident Engineer may issue change orders to the Contractor within the limitations set forth in his delegation of authority from the Contracting Officer.
4. Contractor: This term, as used herein, refers to the contractor performing the work.

**Renovation of the 9<sup>th</sup> Floor of Building 1 - Manhattan, NY**

B. VETS 100: Title 38, USC Section 4212(d) and Public Law 105-339, requires that federal contractors report, at least annually, the number and category of veterans who are within their workforce. Submission of the VETS 100 reporting information can be done electronically at: <http://vets100.cudenver.edu>. For procurement awards in excess of \$25,000, this report must be completed and accepted prior to any Federal contract award. Therefore, all potential contractors are encouraged to file every year.

1. Contractor Performance Information FAR Subpart 42.15

(a) As prescribed in Federal Acquisition Regulation (FAR) Part 42.15, the Department of Veterans Affairs (VA) evaluations contractor past performance on all contracts that exceed \$100,000, and shares those evaluations with other Federal Government contract specialists and procurement officials. The FAR requires that the contractor be provided an opportunity to comment on past performance evaluations prior to each report closing. To fulfill this requirement VA uses CPARS an online database, The CPARS database information is shared with the Past Performance Information Retrieval System (PPIRS) database, which is available to all Federal agencies.

(b) Each contractor whose contract award is estimated to exceed \$100,000 is required to register with the CPARS database at the following web address: <https://www.cpars.gov>. Help in registering can be obtained by contacting CPARS Customer Support Desk at (207) 438-1690. Registration should occur no later than thirty days after contract award, and must be kept current should there be any change to the contractor's registered representative.

(c) For contracts with a period of one year or less, the contracting officer will perform a single evaluation when the contract is complete. For contracts exceeding one year, the contracting officer will evaluate the contractor's performance annually. Interim reports will be filed each year until the last year of the contract, when the final report will be completed. The report shall be assigned in CPARS to the contractor's designated representative for comment. The contractor representative will have thirty days to submit any comments and reassign the report to the VA contracting officer.

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(d) Failure to have a current registration with the CPARS database, or to reassign the report to the VA contracting officer within those thirty days, will result in the Government's evaluation being placed on file in the database with a statement that the contractor failed to respond.

C. Selection Procedure - During the review of offers the VA may ask for additional information. The VA may initiate action to award a contract at any point after review of the offers. Therefore, offers should reflect the offeror's best terms both from a technical and cost standpoint.

D. Tentative Schedule:

Request for proposal issued	August 16, 2013
Issue Bid Documents	August 16, 2013
Pre-proposal conference	September 4, 2013
Proposal submitted	September 16, 2013
Contract award	September 30, 2013
Notice to Proceed	October 30, 2013
Construction completion	July 31, 2014

E. Schedule Objectives - The anticipated completion of this project is 270 calendar days after "Notice to Proceed" (NTP).

A3. Cost Range

The anticipated cost range for this project is between \$10,000,000 and \$20,000,000.

A4. Pre-Proposal Conference

A pre-proposal conference will be held on **September 4, 2013 at 9:00am at the Manhattan VA Medical Center, Atrium B on the 1st floor, 423 East 23 Street, New York, NY 10010**. All offerors, consultants, subcontractors, manufacturers and suppliers are invited to attend. The following agenda is furnished for this meeting:

1. Open meeting;
2. Review of project for construction contracting;
3. Specifications, Network analysis system and project phasing;
4. General requirements, Solicitation Documents and Offer Submission Procedure;
5. Review of "Buy American Act";
6. Questions and answers;

- 7. Close; and
- 8. Site walk through (attendance is optional).

A5. SUBCONTRACTING PLAN:

- A. This provision does not apply to bidders or offerors that are classified as small business concerns.
- B. The offerors attention is called to the clause "Small Business and Small Disadvantaged Business Subcontracting Program", as set forth in the General Conditions in the specifications.
- C. The Subcontracting Program states that the each bidder shall submit a subcontracting plan. The VA requires that a draft subcontracting plan be submitted with the technical proposal. The Small Business and Small Disadvantaged Business, Women Owned Small Business, HUB Zone Small Business and Veteran Owned Small Business participation goals for this project, expressed in terms of a percentage of planned subcontracting dollars, are as follows:

SMALL BUSINESS.....	17.7%
SMALL DISADVANTAGED BUSINESS.....	5.0%
WOMEN OWNED SMALL BUSINESS.....	5.0%
HUBZONE SMALL BUSINESS.....	3.0%
VETERAN-OWNED BUSINESS.....	5.0%
SERVICE DISABLED VETERAN OWNED BUSINESS.....	3.0%

B. PART II - RESPONSIBILITIES

B1. VA Team

- A. The Architect Engineer (A/E) of Record is:

Cannon Design  
360 Madison Avenue 11th Floor  
New York City, New York 10017  
T 646.862.7562  
cannondesign.com

- B. The VA team is also comprised of VA Office of Construction & Facilities Management and others at VA Central Office located in Washington, DC, a Resident Engineer (R/E) who will be located at the construction site and VA medical center staff. The coordinator/manager of the VA team will be the Senior Resident Engineer (SRE), who will have Contracting Officer authority.

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## C. PART III - PROPOSAL REQUIREMENTS

## C1. General

- A. Proposals shall be based on solicitation documents issued for RFP Solicitation Number VA101-13-R-0145. Proposals will be in the format stipulated below:
- B. Volume I - Shall consist of a cover sheet displaying the RFP number, contractor name, and an index of the following five factors contained within the volume.

Tab 1: Factor 1 - Corporate Project Experience (Healthcare)

Tab 2: Factor 2 - Construction Management

Tab 3: Factor 3 - Schedule

Tab 4: Factor 4 - Small Disadvantage Business Participation

Tab 5: Factor 5 - Past Performance

Volume II - Shall consist of a cover sheet displaying the RFP number, contractor name, and an index of the following sections in the volume.

Tab 1: Factor 6 - Cost

Tab 2: The completed and signed SF-1442, All blocks under section "OFFER" on page 2 of SF1442 (Item 14 thru 20C) must be completed

Tab 3: Representations and Certification and bid guarantee.

Tab 4: Bid Bond

- C. The offeror shall submit one (1) sealed original offers (Volume I and Volume II), and five (5) copies of their Volume II Technical proposal to the office of Mr. Ed Nicholson, Senior Contracting Officer, Department of Veterans Affairs, Office of Construction & Facilities Management by the date and time shown on the SF 1442. *As a courtesy, submit Volume I and Volume II on a CD in a pdf format.*

## D. Submit sealed offers to:

1. Commercial Delivery Services / Hand Carry (Monday- Friday, 7:30 am to 4:30 PM):

Ed Nicholson

Contracting Officer (003C4C)

8380 Colesville Road, Suite 420

Silver Spring, MD 20910

## 2. US Postal Service Deliveries:

Ed Nicholson  
Contracting Officer (003C4C)  
8380 Colesville Road, Suite 420  
Silver Spring, MD 20910

Note: All proposals should be mailed by fastest traceable means (i.e. FedEx, UPS, Airborne Express, etc) to avoid delays by USPS package irradiation treatment procedure in Washington, DC.

E. Proposals shall be received before 1:00 pm eastern time on September 16, 2013. There will be no public opening of the proposals.

## C2. Proposal Revisions (FAR 52.215-1)

A. If determined to be necessary, proposal revisions will be requested from the proposals received. Negotiations may or may not be conducted with offerors, at the discretion of the Contracting Officer, after which proposal revisions will be requested. Upon the Contracting Officer's request, offerors will be given 7 calendar days to prepare their proposal revisions. Sealed proposal revisions will be submitted as per Part III.C1.C, above, except as noted below and will be due at a time and place to be determined.

B. Offerors submitting proposal revisions will not be requested to re-submit any documents which are unchanged from their initial proposals. They should provide necessary changes to individual paragraphs, as briefly as possible, together with a table of contents, which clarifies where within the initial proposal the additional information or changed documents would be placed. Proposal revisions shall include a completed Solicitation Offer and Award - SF 1442 that acknowledges receiving all amendments, by number. A new bid bond shall be submitted only if the final proposal revisions offeror's price proposal is greater than its initial price proposal.

## C3. COST PROPOSAL REQUIREMENTS

A. Cost proposals shall be submitted on Standard Form 1442, Solicitation, Offer and Award (Construction, Alteration, or Repair).

## C4. Technical Proposal Requirements

A. Submit 5 copies of the technical proposal. The technical proposal shall be divided into the following sections:



**Renovation of the 9<sup>th</sup> Floor of Building 1 - Manhattan, NY**

- Factor 1 - Corporate Project Experience (Healthcare)
- Factor 2 - Construction Management
- Factor 3 - Schedule
- Factor 4 - Small Disadvantage Business Participation; Factor 5 - Past Performance

Offerors must address each item in these sections:

1. Factor 1 - Corporate Project Experience (Healthcare): The Offeror shall demonstrate corporate experience with no less than three healthcare projects of similar size & complexity to the project described in this solicitation completed within the last five years.

For each project provide the following information:

- a) Project title, location and brief description including the building use (Medical Facility, etc.) and contracting method (design build, design bid construct, CM at risk, etc.).
  - b) Project owner, name, and telephone number of owner's contact person.
  - c) Project Design Architect and Engineers (consultants if utilized) and name and telephone number of contact person(s).
  - d) Project Prime Contractor and Major Subcontractors with name and telephone number of contact person(s).
  - e) Project Statistics including start and completion dates (original vs. actual) for design and construction; cost (with brief explanation of what is included in the cost); square footage; foundation type; number of levels; and any awards received.
2. Factor 2 - Construction Management: This section shall include the following subsections:
    - a. Project Personnel Experience (Specialized experience and technical competence). The Offeror shall demonstrate the relevant experience of key project personnel by supplying biographical data to include years with company and position that the individual will hold in regard to this project team:
      - 1) Project Executive
      - 2) Project Manager
      - 3) Superintendent
    - b. Technical/Management Approach - The Offeror shall demonstrate the following, relevant to the subject procurement:
      - 1) Quality Assurance/Quality Control Plan - Include project delivery philosophy, partnering, communication, commitment,

**Renovation of the 9<sup>th</sup> Floor of Building 1 - Manhattan, NY**

- conflict resolution. Plan may also elaborate on Safety, Environmental, ICRA, ILSM, Commissioning, & Leed Program.
- 2) Management Plan/Organizational Chart with Narrative - Include team members submitted under Project Personnel Experience above as well as others as appropriate. Clearly describe the prime responsible firm (or firms if a J/V) and individuals as well as the roles and responsibilities of individuals proposed as consultants and subcontractors. Provide a list of all proposed major subcontractors, including telephone number, address, and name of contact.
3. Factor 3 - Schedule: Offeror shall provide a proposed progress schedule including phasing as described below:
- A. The progress schedule will be in a time scaled bar graph format. The horizontal axis will be scaled for time beginning with the Notice to Proceed and concluding with contract completion. The vertical axis will show the milestones and major portions of the contract work. All schedule items will show a start date and a completion date. The detailed schedule will indicate specific tasks with dates for each step of the process including:
- Construction Period: Mobilization; Demolition method and sequencing; Excavation; Structure Completion; Exterior finishing; Procurement and installation of equipment; Provisions for overtime or shift work; Timing of relocation of existing utilities; Tests and final inspection.
- B. The Offeror shall specify how much allowance has been made for weather delays in the schedule, the days of the week and the hours of construction operations during each phase of the work, and the percentage of contract completion that will be achieved at the end of each month of the contract.
- C. The Offeror shall address incremental phasing of work on adjacent wards (below the 9<sup>th</sup> floor) for rough in, asbestos, ceiling work, etc.
4. Factor 4 - Small Business Participation:
- A. Offeror shall identify whether offeror is a large business or small business. If offeror is a small business as defined in FAR 52.219-8, indicate the applicable category (ies) as listed in the table below.

Business Category	Qualify (Yes or No)
Service Disabled Veteran Owned	

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Small Business	
Veteran Owned Small Business	
Small Disadvantaged Business (including 8a)	
HUBZone Business	
Women Owned Small Business	
Small Business	

B. Large business offeror shall provide the following as part of their offers:

1. Provide a description of the offeror's Veteran Owned Small Business and Service Disabled Veteran Owned Small Business outreach efforts. Include conferences attended, event sponsorships, mentor-protégé relationships, company spin-offs, and other efforts to encourage, sponsor, of facilitate Veteran Owned and Service Disabled Veteran Owned Small Business growth. Identify small business participation in management.
2. State the offeror's Small Business utilization plan, expressed as percentages of the total subcontracting dollars anticipated for this project for the following class of businesses: Service-Disabled Veteran-Owned Small Business Veteran-Owned Small Business, Small Disadvantaged Business (including 8a), HUBZone business, woman-owned small business, Small Business. Provide an explanation of how the offeror's subcontractor planned goals for this project were derived. Compare the planned values to the stated goals for this project.
3. Provide a table comparing the Contract Goals, Approved Subcontracting Plan Goals, and Goals actually met for all federal construction projects completed within the last five years. Provide an explanation for any goals not met.

5. Factor 5: Past Performance:

- A. The contractor shall send out the attached past performance surveys to each of their references listed under Factor 1, Corporate Project Experience (Healthcare) above. The Government will evaluate the quality and extent of offeror's performance deemed relevant to the requirements of this solicitation. The

**Renovation of the 9<sup>th</sup> Floor of Building 1 - Manhattan, NY**

references must return the survey directly to the Government Contract Specialist listed on the survey via email. The government will use information submitted by the offeror and other sources such as Government past performance systems, other Federal government offices, and commercial sources to assess performance.

- B. Offerors may include copies of awards received for each project above.
- C. Offerors should follow-up and encourage references to return the questionnaires in a timely manner.

## Past Performance Evaluation and Questionnaire Form

Contractor

Project

Company Official

Phone

Email

Date

Part 1 - Provide a rating of Outstanding, Good, Acceptable, Marginal, Unsatisfactory, or Unknown for each of the following questions. How would you rate:

Question	O	G	A	M	U	Un	Comments
1. Contractor's ability to comply with the contract requirements?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
2. Contractor's overall ability to effectively manage the cost of the project?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
3. Contractor's overall ability to effectively manage the schedule of the project?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
4. Contractor's overall ability to effectively manage risk on the project?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
5. Contractor's ability to effectively implement a quality control program for the project?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
6. Contractor's on-site management?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
7. Contractor's responsiveness towards safety issues?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
8. Contractor's responsiveness to addressing punchlist items and warranty calls?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
9. Your overall satisfaction with the end product?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
10. Your overall satisfaction with the Contractor's performance?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	

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Part 2 – In answering the following questions, please provide insights on how the construction project has progressed over the course of the performance period, Contractor's management approach and capabilities, and compliance with project requirements.

Question	Comment
1. Is/has the project progressed in a timely manner consistent with the construction schedule?	
2. Have critical milestone been successfully met? If not, why?	
3. Is/has the project stayed within budget? If not, is it over or under budget and by how much?	
4. Are there any open or anticipated financial actions, such as requests for equitable adjustments or claims?	
5. Has the scope of the project changed over the course of construction? If so, were these changes Owner or Contractor initiated?	
6. Did the Contractor present any value engineering proposal(s)? If so, did the Owner accept the proposal(s)?	
7. Was the Contractor cooperative in resolving issues?	
8. Were there any significant risks involved in performance of this effort?	
9. Did the company appear to apply sufficient resources (personnel and facilities) to the effort?	
10. Were there any changes in the Contractor's key personnel over the course of the construction? If so, how often and why?	

11. Did subcontractors perform the bulk of the effort or just add depth on particular technical areas?

12. What are the Company's strong points?

13. What are the Company's weak points?

14. Do you have any reservations about recommending a future contract award to this Company?

15. Do you know of anyone else who might have past performance information on the Company?

## C5 Selection Criteria

- A. General proposals will be evaluated and award will be made on the basis of Lowest Priced, Technically Acceptable (LPTA) approach. All evaluation factors other than cost or price, when combined, are considered significantly less important than cost. Offerors are advised that if the technical proposals are considered to be essentially equal, the award will be based on the basis of lowest price. Responsibility determination will be made in accordance with **FAR 9.1 Responsible Prospective Contractors.**
- D. Evaluations will be based on the following six (6) factors of equal importance:
1. Factor 1 - Corporate Project Experience (Healthcare): This factor will be evaluated on the basis of corporate project experience with projects of similar size, scope, and complexity to the project described in this solicitation.
  2. Factor 2 - Construction Management: Evaluation of Construction Management will be based on the technical competence, capability, experience, and the overall project team organization. The offeror's project team organization chart, narrative, and experience/resumes of key personnel will be the basis for the evaluation.
    - a) Personnel Experience (each sub-factor is of equal importance)
      - (1). Project Executive
      - (2). Construction Project Manager
      - (3). Superintendent
    - b) Management Approach (each sub-factor is of equal importance)
      - (1). Quality Assurance/Quality Control (QA/QC) plan - Include project delivery philosophy, partnering, communication, commitment, conflict resolution. Plan may also elaborate on Safety, Environmental, ICRA, ILSM, Commissioning, & Leed Program.
      - (2). Management Plan/Organizational Chart & Narrative - Include team members submitted under Project Personnel Experience above as well as others as appropriate. Clearly describe the prime responsible firm (or firms if a J/V) and individuals as well as the roles and responsibilities of individuals proposed as consultants and subcontractors. Provide a list of all proposed major subcontractors, including telephone number, address, and name of contact.



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3. Factor 3 - Schedule: The schedule will be evaluated on the basis of technical merit and approach to complete the project within the phasing parameters and specified project duration.
4. Factor 4 - Small Business Participation Evaluation:

This factor will be evaluated based on the following:

1. Offeror is a Small Business
  2. Large business who offer as the Prime with a qualified subcontracting plan demonstrating proposed small business utilization.
5. Factor 5 - Past Performance: This factor will be evaluated based on overall client satisfaction, which may or may not include schedule, budget, and/or management approach of the referenced projects.

Note: In accordance with FAR 15.305, if an offeror has no record of relevant past performance or for whom information on past performance is not available, the offeror may not be evaluated favorably or unfavorably on past performance.

6. Factor 6, Cost will be evaluated on the basis of lowest price to the government based on the Base Bid.

**E. PART IV - POST AWARD REQUIREMENTS**

1. Project Progress Meeting: A project progress meeting will be held weekly to coordinate the project with the Resident Engineer and the Manhattan Campus of the VA NY Harbor Healthcare System. The contractor will provide written meeting minutes.

2. PARTNERING:

(a) In order to most effectively accomplish this contract, the Government proposes to form a cohesive partnership with the Contractor and its subcontractors. This partnership would strive to draw on the strengths of each organization in an effort to achieve a quality project, done right the first time, within the budget and on schedule.

(b) This partnership will be totally voluntary. The focus of partnering is to build cooperative relationships with the private sector and avoid or minimize disputes and to nurture a more collaborative ethic characterized by trust, cooperation and teamwork. Partnering is defined as the creation of a relationship between the

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owner and contractor that promotes mutual and beneficial goals. It is a non-contractual, but formally structured agreement between the parties. The ultimate goal is the elimination of the "us" versus "them" thinking, and formation of a "we" mentality for the benefit of the project.

(c) Any cost associated with effectuating this partnership will be agreed to by both parties and will be shared equally with no change in contract price.

- - - E N D - - -

## INFORMATION REGARDING BIDDING MATERIAL, BID GUARANTEE AND BONDS

(a) Solicitation materials consisting of drawings, specifications and contract forms may be downloaded at [www.fbo.gov](http://www.fbo.gov), by qualified General (Prime) Contractors interested in submitting proposals direct to the Department of Veteran Affairs. General (Prime) Contractors may provide these materials to subcontractors for their use in preparing sub bids for General (Prime) Contractors. All General (Prime) Contractors must be registered in the System for Award Management (SAM) database at <http://www.sam.gov> prior to award. Any Service Disabled Veteran Owned Small Business or Veteran Owned Small Business submitting a proposal as a General (Prime) Contractor must be listed in VetBiz. By registering for the Register to Receive Notification list at <http://www.fedbizopps.gov>, you will be notified by e-mail of any new amendments that have been issued and posted. No other notification of amendments will be provided. Potential Offerors are advised that they are responsible for obtaining and acknowledging any amendments to the solicitation. There will be no public opening of the proposals received as a result of this solicitation.

(b) One set of drawings and specifications may be obtained by Builders Exchanges, Chambers of Commerce, Quantity Surveyors, trade and microfilming organizations.

(c) Subcontractors, material firms and others interested in preparing sub bids may, upon application to the issuing office, obtain a list of organizations, such as Builders Exchanges, Chambers of Commerce, Contractors and others, who have received bidding materials.

(d) If you decide not to bid on this project, please advise the issuing office of your reasons.

(e) A bid guarantee is required in an amount not less than 20 percent of the bid price but shall not exceed \$3,000,000. Failure to furnish the required bid guarantee in the proper form and amount, by the time set for opening of bids, will require rejection of the bid in all cases except those listed in FAR 28.101-4, and may be cause for rejection even then.

(f) If the contract will exceed \$100,000 (see FAR 28.102-1 for lesser amount), the bidder to whom award is made will be required to furnish two bonds, a Payment Bond, SF 25A, and a Performance Bond, SF 25, each in the penal sum as noted in the General Conditions of the Specification. Copies of SFs 25 and 25A may be obtained upon application to the issuing office.

(g) Offerors are responsible for proving and maintaining all insurance and supplemental insurance requirements under FAR 52.228-5 and FAR 52.307-2, as well as, builders risk insurance (to cover events such as hurricanes, seismic, theft, etc.)

(h) Offerors shall comply with all Federal, State, and local tax laws in accordance with FAR 52.229-3. Offerors shall include municipal taxes in their proposals but should not include taxes as separate line item.

(i) Offerors are advised that the Government may make award without discussions, clarifications or any contact concerning the proposals received. Therefore, proposal should be submitted initially on the most favorable terms. Do not assume that offerors will be contacted or afforded an opportunity to clarify, discuss, or revise their proposals.

### DESCRIPTION OF WORK:

Cost Range: \$10,000,000.00 to \$20,000,000.00.

## INSTRUCTIONS, CONDITIONS AND OTHER STATEMENTS TO BIDDERS/OFFERORS

### 2.1 52.216-1 TYPE OF CONTRACT (APR 1984)

The Government contemplates award of a Firm-Fixed-Price contract resulting from this solicitation.

(End of Provision)

### 2.2 52.222-5 DAVIS-BACON ACT--SECONDARY SITE OF THE WORK (JUL 2005)

(a)(1) The offeror shall notify the Government if the offeror intends to perform work at any secondary site of the work, as defined in paragraph (a)(1)(ii) of the FAR clause at 52.222-6, Davis-Bacon Act, of this solicitation.

(2) If the offeror is unsure if a planned work site satisfies the criteria for a secondary site of the work, the offeror shall request a determination from the Contracting Officer.

(b)(1) If the wage determination provided by the Government for work at the primary site of the work is not applicable to the secondary site of the work, the offeror shall request a wage determination from the Contracting Officer.

(2) The due date for receipt of offers will not be extended as a result of an offeror's request for a wage determination for a secondary site of the work.

(End of Provision)

### 2.3 52.222-23 NOTICE OF REQUIREMENT FOR AFFIRMATIVE ACTION TO ENSURE EQUAL EMPLOYMENT OPPORTUNITY FOR CONSTRUCTION (FEB 1999)

(a) The offeror's attention is called to the Equal Opportunity clause and the Affirmative Action Compliance Requirements for Construction clause of this solicitation.

(b) The goals for minority and female participation, expressed in percentage terms for the Contractor's aggregate workforce in each trade on all construction work in the covered area, are as follows:

Goals for minority participation for each trade		Goals for female participation for each trade
The following goal ranges are applicable to the indicated trades in the counties of Bronx, Kings, New York, Queens, and Richmond.		6.9 %
<b><u>Trade</u></b>	<b><u>Percentage (%)</u></b>	
Electricians	9.0 to 10.2	
Carpenters	27.6 to 32.0	
Steam fitters	12.2 to 13.5	

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Metal lathers	24.6 to 25.6	
Painters	28.6 to 26.0	
Operating Engineers	25.6 to 26.0	
Plumbers	12.0 to 14.5	
Iron workers (struct)	25.9 to 32.0	
Elevator constructors	5.5 to 6.5	
Bricklayers	13.4 to 15.5	
Asbestos workers	22.8 to 28.0	
Roofers	6.3 to 7.5	
Iron workers (ornamental)	22.4 to 23.0	
Cement masons	23.0 to 27.0	
Glaziers	16.0 to 20.0	
Plasterers	15.8 to 18.0	
Teamsters	22.0 to 22.5	
Boilermakers	13.0 to 15.5	
All others	16.4 to 17.5	

These goals are applicable to all the Contractor's construction work performed in the covered area. If the Contractor performs construction work in a geographical area located outside of the covered area, the Contractor shall apply the goals established for the geographical area where the work is actually performed. Goals are published periodically in the Federal Register in notice form, and these notices may be obtained from any Office of Federal Contract Compliance Programs office.

(c) The Contractor's compliance with Executive Order 11246, as amended, and the regulations in 41 CFR 60-4 shall be based on (1) its implementation of the Equal Opportunity clause, (2) specific affirmative action obligations required by the clause entitled "Affirmative Action Compliance Requirements for Construction," and (3) its efforts to meet the goals. The hours of minority and female employment and training must be substantially uniform throughout the length of the contract, and in each trade. The Contractor shall make a good faith effort to employ minorities and women evenly on each of its projects. The transfer of minority or female employees or trainees from Contractor to Contractor, or from project to project, for the sole purpose of meeting the Contractor's goals shall be a violation of the contract, Executive Order 11246, as amended, and the regulations in 41 CFR 60-4. Compliance with the goals will be measured against the total work hours performed.

(d) The Contractor shall provide written notification to the Deputy Assistant Secretary for Federal Contract Compliance, U.S. Department of Labor, within 10 working days following award of any construction subcontract in excess of \$10,000 at any tier for construction work under the contract resulting from this solicitation. The notification shall list the--

- (1) Name, address, and telephone number of the subcontractor;

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- (2) Employer's identification number of the subcontractor;
- (3) Estimated dollar amount of the subcontract;
- (4) Estimated starting and completion dates of the subcontract; and
- (5) Geographical area in which the subcontract is to be performed.

(e) As used in this Notice, and in any contract resulting from this solicitation, the "covered area" is  
The County of New York of the State of New York

## **2.4 52.225-12 NOTICE OF BUY AMERICAN ACT REQUIREMENT --CONSTRUCTION MATERIALS UNDER TRADE AGREEMENTS (FEB 2009) ALTERNATE I (MAY 2002)**

(a) *Definitions.* "Commercially available off-the-shelf (COTS) item," "construction material," "designated country construction material," "domestic construction material," and "foreign construction material," as used in this provision, are defined in the clause of this solicitation entitled "Buy American Act--Construction Materials Under Trade Agreements" (Federal Acquisition Regulation (FAR) clause 52.225-11).

(b) *Requests for determination of inapplicability.* An offeror requesting a determination regarding the inapplicability of the Buy American Act shall submit the request with its offer, including the information and applicable supporting data required by paragraphs (c) and (d) of FAR clause 52.225-11.

(c) Evaluation of offers.

(1) The Government will evaluate an offer requesting exception to the requirements of the Buy American Act, based on claimed unreasonable cost of domestic construction materials, by adding to the offered price the appropriate percentage of the cost of such foreign construction material, as specified in paragraph (b)(4)(i) of FAR clause 52.225-11.

(2) If evaluation results in a tie between an offeror that requested the substitution of foreign construction material based on unreasonable cost and an offeror that did not request an exception, the Contracting Officer will award to the offeror that did not request an exception based on unreasonable cost.

(d) Alternate offers.

(1) When an offer includes foreign construction material, other than designated country construction material, that is not listed by the Government in this solicitation in paragraph (b)(3) of FAR clause 52.225-11, the offeror also may submit an alternate offer based on use of equivalent domestic or designated country construction material.

(2) If an alternate offer is submitted, the offeror shall submit a separate Standard Form 1442 for the alternate offer, and a separate price comparison table prepared in accordance with paragraphs (c) and (d) of FAR clause 52.225-11 for the offer that is based on the use of any foreign construction material for which the Government has not yet determined an exception applies.

(3) If the Government determines that a particular exception requested in accordance with paragraph (c) of FAR clause 52.225-11 does not apply, the Government will evaluate only those offers based on use of the equivalent domestic or designated country construction material, and the offeror shall be required to furnish such domestic or designated country construction material. An offer based on use of the foreign construction material for which an exception was requested--

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- (i) Will be rejected as nonresponsive if this acquisition is conducted by sealed bidding; or
- (ii) May be accepted if revised during negotiations.

(End of Provision)

**2.5 52.228-1 BID GUARANTEE (SEP 1996)**

(a) Failure to furnish a bid guarantee in the proper form and amount, by the time set for opening of bids, may be cause for rejection of the bid.

(b) The bidder shall furnish a bid guarantee in the form of a firm commitment, e.g., bid bond supported by good and sufficient surety or sureties acceptable to the Government, postal money order, certified check, cashier's check, irrevocable letter of credit, or, under Treasury Department regulations, certain bonds or notes of the United States. The Contracting Officer will return bid guarantees, other than bid bonds, (1) to unsuccessful bidders as soon as practicable after the opening of bids, and (2) to the successful bidder upon execution of contractual documents and bonds (including any necessary coinsurance or reinsurance agreements), as required by the bid as accepted.-

(c) The amount of the bid guarantee shall be 20 percent of the bid price or \$3,000,000, whichever is less.-

(d) If the successful bidder, upon acceptance of its bid by the Government within the period specified for acceptance, fails to execute all contractual documents or furnish executed bond(s) within 10 days after receipt of the forms by the bidder, the Contracting Officer may terminate the contract for default.

(e) In the event the contract is terminated for default, the bidder is liable for any cost of acquiring the work that exceeds the amount of its bid, and the bid guarantee is available to offset the difference.

(End of Provision)

**2.6 52.233-2 SERVICE OF PROTEST (SEP 2006)**

Protests, as defined in section 33.101 of the Federal Acquisition Regulation, that are filed directly with an agency, and copies of any protests that are filed with the Government Accountability Office (GAO), shall be served on the Contracting Officer (addressed as follows) by obtaining written and dated acknowledgment of receipt from:

Ed Nicholson  
Contracting Officer

Hand-Carried Address:

Dept of Veteran Affairs, Office of  
Construction and Facilities Management  
Eastern Regional Office (003C4C)  
8380 Colesville Road, Suite 420  
Silver Spring MD 20410

Mailing Address:

Dept of Veteran Affairs, Office of  
Construction and Facilities Management  
Eastern Regional Office (003C4C)  
8380 Colesville Road, Suite 420  
Silver Spring MD 20410

(b) The copy of any protest shall be received in the office designated above within one day of filing a protest with the GAO.

(End of Provision)

## **2.7 52.236-27 SITE VISIT (CONSTRUCTION) (FEB 1995) ALTERNATE I (FEB 1995)**

(a) The clauses at 52.236-2, Differing Site Conditions, and 52.236-3, Site Investigations and Conditions Affecting the Work, will be included in any contract awarded as a result of this solicitation. Accordingly, offerors or quoters are urged and expected to inspect the site where the work will be performed.

(b) An organized site visit has been scheduled for-

Wednesday, September 4, 2013 from 9:00am to 12:00pm ET

(c) Participants will meet at-

Manhattan Campus, VA NY Harbor Healthcare System

423 East 23rd Street  
New York, NY 10010

1<sup>st</sup> Floor, Atrium B

(End of Provision)

## **2.8 52.252-1 SOLICITATION PROVISIONS INCORPORATED BY REFERENCE (FEB 1998)**

This solicitation incorporates one or more solicitation provisions by reference, with the same force and effect as if they were given in full text. Upon request, the Contracting Officer will make their full text available. The offeror is cautioned that the listed provisions may include blocks that must be completed by the offeror and submitted with its quotation or offer. In lieu of submitting the full text of those provisions, the offeror may identify the provision by paragraph identifier and provide the appropriate information with its quotation or offer. Also, the full text of a solicitation provision may be accessed electronically at this/these address(es):

<http://www.acquisition.gov/far/index.html>  
<http://www.va.gov/oal/library/vaar/>

(End of Provision)



<u>FAR</u> <u>Number</u>	<u>Title</u>	<u>Date</u>
52.215-1	INSTRUCTIONS TO OFFERORS--COMPETITIVE ACQUISITION	JAN 2004
52.232-38	SUBMISSION OF ELECTRONIC FUNDS TRANSFER INFORMATION WITH OFFER	MAY 1999
52.236-28	PREPARATION OF PROPOSALS--CONSTRUCTION	OCT 1997

## **2.9 VAAR 852.215-70 SERVICE-DISABLED VETERAN-OWNED AND VETERAN-OWNED SMALL BUSINESS EVALUATION FACTORS (DEC 2009)**

(a) In an effort to achieve socioeconomic small business goals, depending on the evaluation factors included in the solicitation, VA shall evaluate offerors based on their service-disabled veteran-owned or veteran-owned small business status and their proposed use of eligible service-disabled veteran-owned small businesses and veteran-owned small businesses as subcontractors.

(b) Eligible service-disabled veteran-owned offerors will receive full credit, and offerors qualifying as veteran-owned small businesses will receive partial credit for the Service-Disabled Veteran-Owned and Veteran-owned Small Business Status evaluation factor. To receive credit, an offeror must be registered and verified in Vendor Information Pages (VIP) database. (<http://www.VetBiz.gov>).

(c) Non-veteran offerors proposing to use service-disabled veteran-owned small businesses or veteran-owned small businesses as subcontractors will receive some consideration under this evaluation factor. Offerors must state in their proposals the names of the SDVOSBs and VOSBs with whom they intend to subcontract and provide a brief description of the proposed subcontracts and the approximate dollar values of the proposed subcontracts. In addition, the proposed subcontractors must be registered and verified in the VetBiz.gov VIP database (<http://www.vetbiz.gov>).

(End of Provision)

## **2.10 VAAR 852.219-71 VA MENTOR-PROTÉGÉ PROGRAM (DEC 2009)**

(a) Large businesses are encouraged to participate in the VA Mentor-Protégé Program for the purpose of providing developmental assistance to eligible service-disabled veteran-owned small businesses and veteran-owned small businesses to enhance the small businesses' capabilities and increase their participation as VA prime contractors and as subcontractors.

(b) The program consists of:

(1) Mentor firms, which are contractors capable of providing developmental assistance;

(2) Protégé firms, which are service-disabled veteran-owned small business concerns or veteran-owned small business concerns; and

(3) Mentor-Protégé Agreements approved by the VA Office of Small and Disadvantaged Business Utilization.

(c) Mentor participation in the program means providing business developmental assistance to aid protégés in developing the requisite expertise to effectively compete for and successfully perform VA prime contracts and subcontracts.

(d) Large business prime contractors serving as mentors in the VA Mentor-Protégé Program are eligible for an incentive for subcontracting plan credit. VA will recognize the costs incurred by a mentor firm in providing assistance to a protégé firm and apply those costs for purposes of determining whether the mentor firm attains its subcontracting plan

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participation goals under a VA contract. The amount of credit given to a mentor firm for these protégé developmental assistance costs shall be calculated on a dollar-for-dollar basis and reported by the large business prime contractor via the Electronic Subcontracting Reporting System (eSRS).

(e) Contractors interested in participating in the program are encouraged to contact the VA Office of Small and Disadvantaged Business Utilization for more information.

(End of Clause)

**2.11 VAAR 852.228-72 ASSISTING SERVICE-DISABLED VETERAN-OWNED AND VETERAN-OWNED SMALL BUSINESSES IN OBTAINING BONDS (DEC 2009)**

Prime contractors are encouraged to assist service-disabled veteran-owned and veteran-owned small business potential subcontractors in obtaining bonding, when required. Mentor firms are encouraged to assist protégé firms under VA's Mentor-Protégé Program in obtaining acceptable bid, payment, and performance bonds, when required, as a prime contractor under a solicitation or contract and in obtaining any required bonds under subcontracts.

(End of Clause)

**2.12 VAAR 852.233-70 PROTEST CONTENT/ALTERNATIVE DISPUTE RESOLUTION (JAN 2008)**

(a) Any protest filed by an interested party shall:

- (1) Include the name, address, fax number, and telephone number of the protester;
- (2) Identify the solicitation and/or contract number;
- (3) Include an original signed by the protester or the protester's representative and at least one copy;
- (4) Set forth a detailed statement of the legal and factual grounds of the protest, including a description of resulting prejudice to the protester, and provide copies of relevant documents;
- (5) Specifically request a ruling of the individual upon whom the protest is served;
- (6) State the form of relief requested; and
- (7) Provide all information establishing the timeliness of the protest.

(b) Failure to comply with the above may result in dismissal of the protest without further consideration.

(c) Bidders/offerors and contracting officers are encouraged to use alternative dispute resolution (ADR) procedures to resolve protests at any stage in the protest process. If ADR is used, the Department of Veterans Affairs will not furnish any documentation in an ADR proceeding beyond what is allowed by the Federal Acquisition Regulation.

(End of Provision)

**2.13 VAAR 852.233-71 ALTERNATE PROTEST PROCEDURE (JAN 1998)**

As an alternative to filing a protest with the contracting officer, an interested party may file a protest with the Deputy Assistant Secretary for Acquisition and Materiel Management, Acquisition Administration Team, Department of Veterans Affairs, 810 Vermont Avenue, NW., Washington, DC 20420, or for solicitations issued by the Office of Construction and Facilities Management, the Director, Office of Construction and Facilities Management, 810 Vermont Avenue, NW.,

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Washington, DC 20420. The protest will not be considered if the interested party has a protest on the same or similar issues pending with the contracting officer.

(End of Provision)

PLEASE NOTE: The correct mailing information for filing alternate protests is as follows:

Deputy Assistant Secretary for Acquisition and Logistics,  
Risk Management Team, Department of Veterans Affairs  
810 Vermont Avenue, N.W.  
Washington, DC 20420

Or for solicitations issued by the Office of Construction and Facilities Management:

Director, Office of Construction and Facilities Management  
811 Vermont Avenue, N.W.  
Washington, DC 20420

**2.14 VAAR 852.270-1 REPRESENTATIVES OF CONTRACTING OFFICERS (JAN 2008)**

The contracting officer reserves the right to designate representatives to act for him/her in furnishing technical guidance and advice or generally monitor the work to be performed under this contract. Such designation will be in writing and will define the scope and limitation of the designee's authority. A copy of the designation shall be furnished to the contractor.

(End of Provision)

**2.15 LIMITATIONS ON SUBCONTRACTING-- MONITORING AND COMPLIANCE (JUN 2011)**

This solicitation includes FAR 52.219-4 Notice of Price Evaluation Preference for HubZone Small Business Concerns - Alternate I. Accordingly, any contract resulting from this solicitation will include this clause. The contractor is advised in performing contract administration functions, the CO may use the services of a support contractor(s) retained by VA to assist in assessing the contractor's compliance with the limitations on subcontracting or percentage of work performance requirements specified in the clause. To that end, the support contractor(s) may require access to contractor's offices where the contractor's business records or other proprietary data are retained and to review such business records regarding the contractor's compliance with this requirement. All support contractors conducting this review on behalf of VA will be required to sign an "Information Protection and Non-Disclosure and Disclosure of Conflicts of Interest Agreement" to ensure the contractor's business records or other proprietary data reviewed or obtained in the course of assisting the CO in assessing the contractor for compliance are protected to ensure information or data is not improperly disclosed or other impropriety occurs. Furthermore, if VA determines any services the support contractor(s) will perform in assessing compliance are advisory and assistance services as defined in FAR 2.101, Definitions, the support contractor(s) must also enter into an agreement with the contractor to protect proprietary information as required by FAR 9.505-4, obtaining access to proprietary information, paragraph (b). The contractor is required to cooperate fully and make available any records as may be required to enable the CO to assess the contractor's compliance with the limitations on subcontracting or percentage of work performance requirement.

(End of Clause)

## **2.16 SUBCONTRACTING COMMITMENTS--MONITORING AND COMPLIANCE (JUN 2011)**

This solicitation includes VAAR 852.215-70, Service-Disabled Veteran-Owned and Veteran-Owned Small Business Evaluation Factors, and VAAR 852.215-71, Evaluation Factor Commitments. Accordingly, any contract resulting from this solicitation will include these clauses. The contractor is advised in performing contract administration functions, the CO may use the services of a support contractor(s) to assist in assessing contractor compliance with the subcontracting commitments incorporated into the contract. To that end, the support contractor(s) may require access to the contractor's business records or other proprietary data to review such business records regarding contract compliance with this requirement. All support contractors conducting this review on behalf of VA will be required to sign an "Information Protection and Non-Disclosure and Disclosure of Conflicts of Interest Agreement" to ensure the contractor's business records or other proprietary data reviewed or obtained in the course of assisting the CO in assessing the contractor for compliance are protected to ensure information or data is not improperly disclosed or other impropriety occurs. Furthermore, if VA determines any services the support contractor(s) will perform in assessing compliance are advisory and assistance services as defined in FAR 2.101, Definitions, the support contractor(s) must also enter into an agreement with the contractor to protect proprietary information as required by FAR 9.505-4, obtaining access to proprietary information, paragraph (b). The contractor is required to cooperate fully and make available any records as may be required to enable the CO to assess the contractor compliance with the subcontracting commitments.

(End of Clause)

## **2.17 SUBCONTRACTING PLAN--MONITORING AND COMPLIANCE (JUN 2011)**

This solicitation includes FAR 52.219-9, Small Business Subcontracting Plan, and VAAR 852.219-9, VA Small Business Subcontracting Plan Minimum Requirement. Accordingly, any contract resulting from this solicitation will include these clauses. The contractor is advised in performing contract administration functions, the CO may use the services of a support contractor(s) to assist in assessing the contractor's compliance with the plan, including reviewing the contractor's accomplishments in achieving the subcontracting goals in the plan. To that end, the support contractor(s) may require access to the contractor's business records or other proprietary data to review such business records regarding the contractor's compliance with this requirement. All support contractors conducting this review on behalf of VA will be required to sign an "Information Protection and Non-Disclosure and Disclosure of Conflicts of Interest Agreement" to ensure the contractor's business records or other proprietary data reviewed or obtained in the course of assisting the CO in assessing the contractor for compliance are protected to ensure information or data is not improperly disclosed or other impropriety occurs. Furthermore, if VA determines any services the support contractor(s) will perform in assessing compliance are advisory and assistance services as defined in FAR 2.101, Definitions, the support contractor(s) must also enter into an agreement with the contractor to protect proprietary information as required by FAR 9.505-4, obtaining access to proprietary information, paragraph (b). The contractor is required to cooperate fully and make available any records as may be required to enable the CO to assess the contractor compliance with the subcontracting plan.

(End of Clause)

## REPRESENTATIONS AND CERTIFICATIONS

### 3.1 52.204-8 ANNUAL REPRESENTATIONS AND CERTIFICATIONS (DEC 2012)

(a)(1) The North American Industry Classification System (NAICS) code for this acquisition is 236220.

(2) The small business size standard is \$33.5 Million.

(3) The small business size standard for a concern which submits an offer in its own name, other than on a construction or service contract, but which proposes to furnish a product which it did not itself manufacture, is 500 employees.

(b)(1) If the clause at 52.204-7, System for Award Management, is included in this solicitation, paragraph (d) of this provision applies.

(2) If the clause at 52.204-7 is not included in this solicitation, and the offeror is currently registered in the System for Award Management (SAM), and has completed the ORCA electronically, the offeror may choose to use paragraph (d) of this provision instead of completing the corresponding individual representations and certifications in the solicitation. The offeror shall indicate which option applies by checking one of the following boxes:

☐ (i) Paragraph (d) applies.

☐ (ii) Paragraph (d) does not apply and the offeror has completed the individual representations and certifications in the solicitation.

(c)(1) The following representations or certifications in ORCA are applicable to this solicitation as indicated:

(i) 52.203-2, Certificate of Independent Price Determination. This provision applies to solicitations when a firm-fixed-price contract or fixed-price contract with economic price adjustment is contemplated, unless--

(A) The acquisition is to be made under the simplified acquisition procedures in Part 13;

(B) The solicitation is a request for technical proposals under two-step sealed bidding procedures; or

(C) The solicitation is for utility services for which rates are set by law or regulation.

(ii) 52.203-11, Certification and Disclosure Regarding Payments to Influence Certain Federal Transactions. This provision applies to solicitations expected to exceed \$150,000.

(iii) 52.204-3, Taxpayer Identification. This provision applies to solicitations that do not include the clause at 52.204-7, Central Contractor Registration.

(iv) 52.204-5, Women-Owned Business (Other Than Small Business). This provision applies to solicitations that--

(A) Are not set aside for small business concerns;

(B) Exceed the simplified acquisition threshold; and

(C) Are for contracts that will be performed in the United States or its outlying areas.

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(v) 52.209-2, Prohibition on Contracting with Inverted Domestic Corporations--Representation. This provision applies to solicitations using funds appropriated in fiscal years 2008, 2009, 2010, or 2012.

(vi) 52.209-5, Certification Regarding Responsibility Matters. This provision applies to solicitations where the contract value is expected to exceed the simplified acquisition threshold.

(vii) 52.214-14, Place of Performance--Sealed Bidding. This provision applies to invitations for bids except those in which the place of performance is specified by the Government.

(viii) 52.215-6, Place of Performance. This provision applies to solicitations unless the place of performance is specified by the Government.

(ix) 52.219-1, Small Business Program Representations (Basic & Alternate I). This provision applies to solicitations when the contract will be performed in the United States or its outlying areas.

(A) The basic provision applies when the solicitations are issued by other than DoD, NASA, and the Coast Guard.

(B) The provision with its Alternate I applies to solicitations issued by DoD, NASA, or the Coast Guard.

(x) 52.219-2, Equal Low Bids. This provision applies to solicitations when contracting by sealed bidding and the contract will be performed in the United States or its outlying areas.

(xi) 52.222-22, Previous Contracts and Compliance Reports. This provision applies to solicitations that include the clause at 52.222-26, Equal Opportunity.

(xii) 52.222-25, Affirmative Action Compliance. This provision applies to solicitations, other than those for construction, when the solicitation includes the clause at 52.222-26, Equal Opportunity.

(xiii) 52.222-38, Compliance with Veterans' Employment Reporting Requirements. This provision applies to solicitations when it is anticipated the contract award will exceed the simplified acquisition threshold and the contract is not for acquisition of commercial items.

(xiv) 52.223-1, Biobased Product Certification. This provision applies to solicitations that require the delivery or specify the use of USDA-designated items; or include the clause at 52.223-2, Affirmative Procurement of Biobased Products Under Service and Construction Contracts.

(xv) 52.223-4, Recovered Material Certification. This provision applies to solicitations that are for, or specify the use of, EPA-designated items.

(xvi) 52.225-2, Buy American Act Certificate. This provision applies to solicitations containing the clause at 52.225-1.

(xvii) 52.225-4, Buy American Act--Free Trade Agreements--Israeli Trade Act Certificate. (Basic, Alternates I, II, and III.) This provision applies to solicitations containing the clause at 52.225-3.

(A) If the acquisition value is less than \$25,000, the basic provision applies.

(B) If the acquisition value is \$25,000 or more but is less than \$50,000, the provision with its Alternate I applies.

(C) If the acquisition value is \$50,000 or more but is less than \$77,494, the provision with its Alternate II applies.

(D) If the acquisition value is \$77,494 or more but is less than \$100,000, the provision with its Alternate III applies.

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(xviii) 52.225-6, Trade Agreements Certificate. This provision applies to solicitations containing the clause at 52.225-5.

(xix) 52.225-20, Prohibition on Conducting Restricted Business Operations in Sudan--Certification. This provision applies to all solicitations.

(xx) 52.225-25, Prohibition on Contracting with Entities Engaging in Certain Activities or Transactions Relating to Iran--Representation and Certifications. This provision applies to all solicitations.

(xxi) 52.226-2, Historically Black College or University and Minority Institution Representation. This provision applies to--

(A) Solicitations for research, studies, supplies, or services of the type normally acquired from higher educational institutions; and

(B) For DoD, NASA, and Coast Guard acquisitions, solicitations that contain the clause at 52.219-23, Notice of Price Evaluation Adjustment for Small Disadvantaged Business Concerns.

(2) The following certifications are applicable as indicated by the Contracting Officer:

☐ (i) 52.219-22, Small Disadvantaged Business Status.

☐ (A) Basic.

☐ (B) Alternate I.

☐ (ii) 52.222-18, Certification Regarding Knowledge of Child Labor for Listed End Products.

☐ (iii) 52.222-48, Exemption from Application of the Service Contract Act to Contracts for Maintenance, Calibration, or Repair of Certain Equipment Certification.

☐ (iv) 52.222-52 Exemption from Application of the Service Contract Act to Contracts for Certain Services--Certification.

☐ (v) 52.223-9, with its Alternate I, Estimate of Percentage of Recovered Material Content for EPA-Designated Products (Alternate I only).

☐ (vi) 52.227-6, Royalty Information.

☐ (A) Basic.

☐ (B) Alternate I.

☐ (vii) 52.227-15, Representation of Limited Rights Data and Restricted Computer Software.

(d) The offeror has completed the annual representations and certifications electronically via the Online Representations and Certifications Application (ORCA) website accessed through <https://www.acquisition.gov>. After reviewing the ORCA database information, the offeror verifies by submission of the offer that the representations and certifications currently posted electronically that apply to this solicitation as indicated in paragraph (c) of this provision have been entered or updated within the last 12 months, are current, accurate, complete, and applicable to this solicitation (including the business size standard applicable to the NAICS code referenced for this solicitation), as of the date of this offer and are incorporated in this offer by reference (see FAR 4.1201); except for the changes identified below [offeror to insert



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changes, identifying change by clause number, title, date]. These amended representation(s) and/or certification(s) are also incorporated in this offer and are current, accurate, and complete as of the date of this offer.

FAR Clause #	Title	Date	Change
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Any changes provided by the offeror are applicable to this solicitation only, and do not result in an update to the representations and certifications posted on ORCA.

(End of Provision)

### **3.2 52.209-5 REPRESENTATION BY CORPORATIONS REGARDING AN UNPAID TAX LIABILITY OR A FELONY CONVICTION UNDER ANY FEDERAL LAW (DEVIATION)(MAR 2012)**

(a) In accordance with Division H, sections 8124 and 8125 of P.L. 112-74 and sections 738 and 739 of P.L. 112-55 none of the funds made available by either Act may be used to enter into a contract with any corporation that—

(1) Has an unpaid federal tax liability, unless the agency has considered suspension or debarment of the corporation and the Suspension and Debarment Official has made a determination that this action is not necessary to protect the interests of the Government.

(2) Has a felony criminal violation under any Federal or State law within the preceding 24 months, unless the agency has considered suspension or debarment of the corporation and Suspension and Debarment Official has made a determination that this action is not necessary to protect the interests of the Government.

(b) The Offeror represents that—

(1) The offeror does [ ] does not [ ] have any unpaid Federal tax liability that has been assessed and that is not being paid in a timely manner pursuant to an agreement with the authority responsible for collecting the tax liability.

(2) The offeror, its officers or agents acting on its behalf have [ ] have not [ ] been convicted of a felony criminal violation under a Federal or State law within the preceding 24 months.

(End of Provision)

### **3.3 52.209-7 INFORMATION REGARDING RESPONSIBILITY MATTERS (FEB 2012)**

(a) *Definitions.* As used in this provision--

"Administrative proceeding" means a non-judicial process that is adjudicatory in nature in order to make a determination of fault or liability (e.g., Securities and Exchange Commission Administrative Proceedings, Civilian Board of Contract Appeals Proceedings, and Armed Services Board of Contract Appeals Proceedings). This includes administrative proceedings at the Federal and State level but only in connection with performance of a Federal contract or grant. It does not include agency actions such as contract audits, site visits, corrective plans, or inspection of deliverables.

"Federal contracts and grants with total value greater than \$10,000,000" means--



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(1) The total value of all current, active contracts and grants, including all priced options; and

(2) The total value of all current, active orders including all priced options under indefinite-delivery, indefinite-quantity, 8(a), or requirements contracts (including task and delivery and multiple-award Schedules).

"Principal" means an officer, director, owner, partner, or a person having primary management or supervisory responsibilities within a business entity (e.g., general manager; plant manager; head of a division or business segment; and similar positions).

(b) The offeror [ ] has [ ] does not have current active Federal contracts and grants with total value greater than \$10,000,000.

(c) If the offeror checked "has" in paragraph (b) of this provision, the offeror represents, by submission of this offer, that the information it has entered in the Federal Awardee Performance and Integrity Information System (FAPIS) is current, accurate, and complete as of the date of submission of this offer with regard to the following information:

(1) Whether the offeror, and/or any of its principals, has or has not, within the last five years, in connection with the award to or performance by the offeror of a Federal contract or grant, been the subject of a proceeding, at the Federal or State level that resulted in any of the following dispositions:

(i) In a criminal proceeding, a conviction.

(ii) In a civil proceeding, a finding of fault and liability that results in the payment of a monetary fine, penalty, reimbursement, restitution, or damages of \$5,000 or more.

(iii) In an administrative proceeding, a finding of fault and liability that results in--

(A) The payment of a monetary fine or penalty of \$5,000 or more; or

(B) The payment of a reimbursement, restitution, or damages in excess of \$100,000.

(iv) In a criminal, civil, or administrative proceeding, a disposition of the matter by consent or compromise with an acknowledgment of fault by the Contractor if the proceeding could have led to any of the outcomes specified in paragraphs (c)(1)(i), (c)(1)(ii), or (c)(1)(iii) of this provision.

(2) If the offeror has been involved in the last five years in any of the occurrences listed in (c)(1) of this provision, whether the offeror has provided the requested information with regard to each occurrence.

(d) The offeror shall post the information in paragraphs (c)(1)(i) through (c)(1)(iv) of this provision in FAPIS as required through maintaining an active registration in the Central Contractor Registration database via <https://www.acquisition.gov> (see 52.204-7).

(End of Provision)

### **3.4 52.225-20 PROHIBITION ON CONDUCTING RESTRICTED BUSINESS OPERATIONS IN SUDAN--CERTIFICATION (AUG 2009)**

(a) *Definitions.* As used in this provision-- "Business operations" means engaging in commerce in any form, including by acquiring, developing, maintaining, owning, selling, possessing, leasing, or operating equipment, facilities, personnel, products, services, personal property, real property, or any other apparatus of business or commerce.

"Marginalized populations of Sudan" means--

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(1) Adversely affected groups in regions authorized to receive assistance under section 8(c) of the Darfur Peace and Accountability Act (Pub. L. 109-344) (50 U.S.C. 1701 note); and

(2) Marginalized areas in Northern Sudan described in section 4(9) of such Act.

"Restricted business operations" means business operations in Sudan that include power production activities, mineral extraction activities, oil-related activities, or the production of military equipment, as those terms are defined in the Sudan Accountability and Divestment Act of 2007 (Pub. L. 110-174). Restricted business operations do not include business operations that the person (as that term is defined in Section 2 of the Sudan Accountability and Divestment Act of 2007) conducting the business can demonstrate-

(1) Are conducted under contract directly and exclusively with the regional government of southern Sudan;

(2) Are conducted pursuant to specific authorization from the Office of Foreign Assets Control in the Department of the Treasury, or are expressly exempted under Federal law from the requirement to be conducted under such authorization;

(3) Consist of providing goods or services to marginalized populations of Sudan;

(4) Consist of providing goods or services to an internationally recognized peacekeeping force or humanitarian organization;

(5) Consist of providing goods or services that are used only to promote health or education; or

(6) Have been voluntarily suspended.

(b) *Certification.* By submission of its offer, the offeror certifies that the offeror does not conduct any restricted business operations in Sudan.

(End of Provision)

<b><u>FAR</u></b> <b><u>Number</u></b>	<b><u>Title</u></b>	<b><u>Date</u></b>
52.225-25	PROHIBITION ON CONTRACTING WITH ENTITIES ENGAGING IN CERTAIN ACTIVITIES OR TRANSACTIONS RELATING TO IRAN-- REPRESENTATION AND CERTIFICATIONS	DEC 2012

## GENERAL CONDITIONS

### 4.1 52.209-9 UPDATES OF PUBLICLY AVAILABLE INFORMATION REGARDING RESPONSIBILITY MATTERS (FEB 2012)

(a) The Contractor shall update the information in the Federal Awardee Performance and Integrity Information System (FAPIIS) on a semi-annual basis, throughout the life of the contract, by posting the required information in the Central Contractor Registration database via <https://www.acquisition.gov>.

(b) As required by section 3010 of the Supplemental Appropriations Act, 2010 (Pub. L. 111-212), all information posted in FAPIIS on or after April 15, 2011, except past performance reviews, will be publicly available. FAPIIS consists of two segments--

(1) The non-public segment, into which Government officials and the Contractor post information, which can only be viewed by--

(i) Government personnel and authorized users performing business on behalf of the Government; or

(ii) The Contractor, when viewing data on itself; and

(2) The publicly-available segment, to which all data in the non-public segment of FAPIS is automatically transferred after a waiting period of 14 calendar days, except for--

(i) Past performance reviews required by subpart 42.15;

(ii) Information that was entered prior to April 15, 2011; or

(iii) Information that is withdrawn during the 14-calendar-day waiting period by the Government official who posted it in accordance with paragraph (c)(1) of this clause.

(c) The Contractor will receive notification when the Government posts new information to the Contractor's record.

(1) If the Contractor asserts in writing within 7 calendar days, to the Government official who posted the information, that some of the information posted to the nonpublic segment of FAPIIS is covered by a disclosure exemption under the Freedom of Information Act, the Government official who posted the information must within 7 calendar days remove the posting from FAPIIS and resolve the issue in accordance with agency Freedom of Information procedures, prior to reposting the releasable information. The contractor must cite 52.209-9 and request removal within 7 calendar days of the posting to FAPIIS.

(2) The Contractor will also have an opportunity to post comments regarding information that has been posted by the Government. The comments will be retained as long as the associated information is retained, i.e., for a total period of 6 years. Contractor comments will remain a part of the record unless the Contractor revises them.

(3) As required by section 3010 of Pub. L. 111-212, all information posted in FAPIIS on or after April 15, 2011, except past performance reviews, will be publicly available.

(d) Public requests for system information posted prior to April 15, 2011, will be handled under Freedom of Information Act procedures, including, where appropriate, procedures promulgated under E.O. 12600.

(End of Clause)

#### **4.2 52.211-10 COMMENCEMENT, PROSECUTION, AND COMPLETION OF WORK (APR 1984) ALTERNATE I (APR 1984)**

The Contractor shall be required to (a) commence work under this contract within 10 calendar days after the date the Contractor receives the notice to proceed, (b) prosecute the work diligently, and (c) complete the entire work ready for use not later than 270 days after receipt of notice to proceed. The time stated for completion shall include final cleanup of the premises.

The completion date is based on the assumption that the successful offeror will receive the notice to proceed by October 15, 2013. The completion date will be extended by the number of calendar days after the above date that the Contractor receives the notice to proceed, except to the extent that the delay in issuance of the notice to proceed results from the failure of the Contractor to execute the contract and give the required performance and payment bonds within the time specified in the offer.

(End of Clause)

#### **4.3 52.211-12 LIQUIDATED DAMAGES--CONSTRUCTION (SEPT 2000)**

(a) If the Contractor fails to complete the work within the time specified in the contract, the Contractor shall pay liquidated damages to the Government in the amount of \$1,439.00 for each calendar day of delay until the work is completed or accepted.

(b) If the Government terminates the Contractor's right to proceed, liquidated damages will continue to accrue until the work is completed. These liquidated damages are in addition to excess costs of repurchase under the Termination clause.

(End of Clause)

#### **4.4 52.219-28 POST-AWARD SMALL BUSINESS PROGRAM REREPRESENTATION (APR 2012)**

(a) *Definitions.* As used in this clause-

*Long-term contract* means a contract of more than five years in duration, including options. However, the term does not include contracts that exceed five years in duration because the period of performance has been extended for a cumulative period not to exceed six months under the clause at 52.217-8, Option to Extend Services, or other appropriate authority.

*Small business concern* means a concern, including its affiliates, that is independently owned and operated, not dominant in the field of operation in which it is bidding on Government contracts, and qualified as a small business under the criteria in 13 CFR part 121 and the size standard in paragraph (c) of this clause. Such a concern is "not dominant in its field of operation" when it does not exercise a controlling or major influence on a national basis in a kind of business activity in which a number of business concerns are primarily engaged. In determining whether dominance exists, consideration shall be given to all appropriate factors, including volume of business, number of employees, financial resources, competitive status or position, ownership or control of materials, processes, patents, license agreements, facilities, sales territory, and nature of business activity.

(b) If the Contractor represented that it was a small business concern prior to award of this contract, the Contractor shall rerepresent its size status according to paragraph (e) of this clause or, if applicable, paragraph (g) of this clause, upon the occurrence of any of the following:

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- (1) Within 30 days after execution of a novation agreement or within 30 days after modification of the contract to include this clause, if the novation agreement was executed prior to inclusion of this clause in the contract.
- (2) Within 30 days after a merger or acquisition that does not require a novation or within 30 days after modification of the contract to include this clause, if the merger or acquisition occurred prior to inclusion of this clause in the contract.
- (3) For long-term contracts-
- (i) Within 60 to 120 days prior to the end of the fifth year of the contract; and
  - (ii) Within 60 to 120 days prior to the date specified in the contract for exercising any option thereafter.
- (c) The Contractor shall rerepresent its size status in accordance with the size standard in effect at the time of this rerepresentation that corresponds to the North American Industry Classification System (NAICS) code assigned to this contract. The small business size standard corresponding to this NAICS code can be found at <http://www.sba.gov/content/table-small-business-size-standards>.
- (d) The small business size standard for a Contractor providing a product which it does not manufacture itself, for a contract other than a construction or service contract, is 500 employees.
- (e) Except as provided in paragraph (g) of this clause, the Contractor shall make the rerepresentation required by paragraph (b) of this clause by validating or updating all its representations in the Online Representations and Certifications Application and its data in the Central Contractor Registration, as necessary, to ensure that they reflect the Contractor's current status. The Contractor shall notify the contracting office in writing within the timeframes specified in paragraph (b) of this clause that the data have been validated or updated, and provide the date of the validation or update.
- (f) If the Contractor represented that it was other than a small business concern prior to award of this contract, the Contractor may, but is not required to, take the actions required by paragraphs (e) or (g) of this clause.
- (g) If the Contractor does not have representations and certifications in ORCA, or does not have a representation in ORCA for the NAICS code applicable to this contract, the Contractor is required to complete the following rerepresentation and submit it to the contracting office, along with the contract number and the date on which the rerepresentation was completed:
- The Contractor represents that it [ ] is, [ ] is not a small business concern under NAICS Code 236220 assigned to contract number .

*[Contractor to sign and date and insert authorized signer's name and title].*

(End of Clause)

#### **4.5 52.222-40 NOTIFICATION OF EMPLOYEE RIGHTS UNDER THE NATIONAL LABOR RELATIONS ACT (DEC 2010)**

- (a) During the term of this contract, the Contractor shall post an employee notice, of such size and in such form, and containing such content as prescribed by the Secretary of Labor, in conspicuous places in and about its plants and offices where employees covered by the National Labor Relations Act engage in activities relating to the performance of the contract, including all places where notices to employees are customarily posted both physically and electronically, in the languages employees speak, in accordance with 29 CFR 471.2(d) and (f).

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(1) Physical posting of the employee notice shall be in conspicuous places in and about the Contractor's plants and offices so that the notice is prominent and readily seen by employees who are covered by the National Labor Relations Act and engage in activities related to the performance of the contract.

(2) If the Contractor customarily posts notices to employees electronically, then the Contractor shall also post the required notice electronically by displaying prominently, on any Web site that is maintained by the Contractor and is customarily used for notices to employees about terms and conditions of employment, a link to the Department of Labor's Web site that contains the full text of the poster. The link to the Department's Web site, as referenced in (b)(3) of this section, must read, "Important Notice about Employee Rights to Organize and Bargain Collectively with Their Employers."

(b) This required employee notice, printed by the Department of Labor, may be-

(1) Obtained from the Division of Interpretations and Standards, Office of Labor-Management Standards, U.S. Department of Labor, 200 Constitution Avenue, NW., Room N-5609, Washington, DC 20210, (202) 693-0123, or from any field office of the Office of Labor-Management Standards or Office of Federal Contract Compliance Programs;

(2) Provided by the Federal contracting agency if requested;

(3) Downloaded from the Office of Labor-Management Standards Web site at <http://www.dol.gov/olms/regs/compliance/EO13496.htm>; or

(4) Reproduced and used as exact duplicate copies of the Department of Labor's official poster.

(c) The required text of the employee notice referred to in this clause is located at Appendix A, Subpart A, 29 CFR Part 471.

(d) The Contractor shall comply with all provisions of the employee notice and related rules, regulations, and orders of the Secretary of Labor.

(e) In the event that the Contractor does not comply with the requirements set forth in paragraphs (a) through (d) of this clause, this contract may be terminated or suspended in whole or in part, and the Contractor may be suspended or debarred in accordance with 29 CFR 471.14 and subpart 9.4. Such other sanctions or remedies may be imposed as are provided by 29 CFR part 471, which implements Executive Order 13496 or as otherwise provided by law.

(f) Subcontracts.

(1) The Contractor shall include the substance of this clause, including this paragraph (f), in every subcontract that exceeds \$10,000 and will be performed wholly or partially in the United States, unless exempted by the rules, regulations, or orders of the Secretary of Labor issued pursuant to section 3 of Executive Order 13496 of January 30, 2009, so that such provisions will be binding upon each subcontractor.

(2) The Contractor shall not procure supplies or services in a way designed to avoid the applicability of Executive Order 13496 or this clause.

(3) The Contractor shall take such action with respect to any such subcontract as may be directed by the Secretary of Labor as a means of enforcing such provisions, including the imposition of sanctions for noncompliance.

(4) However, if the Contractor becomes involved in litigation with a subcontractor, or is threatened with such involvement, as a result of such direction, the Contractor may request the United States, through the Secretary of Labor, to enter into such litigation to protect the interests of the United States.

(End of Clause)

#### **4.6 52.223-2 AFFIRMATIVE PROCUREMENT OF BIOBASED PRODUCTS UNDER SERVICE AND CONSTRUCTION CONTRACTS (JUL 2012)**

(a) In the performance of this contract, the contractor shall make maximum use of biobased products that are United States Department of Agriculture (USDA)-designated items unless--

(1) The product cannot be acquired--

(i) Competitively within a time frame providing for compliance with the contract performance schedule;

(ii) Meeting contract performance requirements; or

(iii) At a reasonable price.

(2) The product is to be used in an application covered by a USDA categorical exemption (see 7 CFR 3201.3(e)). For example, all USDA-designated items are exempt from the preferred procurement requirement for the following:

(i) Spacecraft system and launch support equipment.

(ii) Military equipment, i.e., a product or system designed or procured for combat or combat-related missions.

(b) Information about this requirement and these products is available at <http://www.biopreferred.gov>.

(c) In the performance of this contract, the Contractor shall--

(1) Report to the environmental point of contact identified in paragraph (d) of this clause, with a copy to the Contracting Officer, on the product types and dollar value of any USDA-designated biobased products purchased by the Contractor during the previous Government fiscal year, between October 1 and September 30;

(2) Submit this report no later than--

(i) October 31 of each year during contract performance; and

(ii) At the end of contract performance; and

(3) Contact the environmental point of contact to obtain the preferred submittal format, if that format is not specified in this contract.

(d) The environmental point of contact for this contract is:

Vic Verma

301-565-4401

Vic.Verma@va.gov

(End of Clause)

**4.7 52.223-3 HAZARDOUS MATERIAL IDENTIFICATION AND MATERIAL SAFETY DATA (JAN 1997) ALTERNATE I (JUL 1995)**

(a) "Hazardous material," as used in this clause, includes any material defined as hazardous under the latest version of Federal Standard No. 313 (including revisions adopted during the term of the contract).

(b) The offeror must list any hazardous material, as defined in paragraph (a) of this clause, to be delivered under this contract. The hazardous material shall be properly identified and include any applicable identification number, such as National Stock Number or Special Item Number. This information shall also be included on the Material Safety Data Sheet submitted under this contract.

<b>Material (If none, insert "None")</b>	<b>Identification No.</b>

(c) This list must be updated during performance of the contract whenever the Contractor determines that any other material to be delivered under this contract is hazardous.

(d) The apparently successful offeror agrees to submit, for each item as required prior to award, a Material Safety Data Sheet, meeting the requirements of 29 CFR 1910.1200(g) and the latest version of Federal Standard No. 313, for all hazardous material identified in paragraph (b) of this clause. Data shall be submitted in accordance with Federal Standard No. 313, whether or not the apparently successful offeror is the actual manufacturer of these items. Failure to submit the Material Safety Data Sheet prior to award may result in the apparently successful offeror being considered nonresponsible and ineligible for award.

(e) If, after award, there is a change in the composition of the item(s) or a revision to Federal Standard No. 313, which renders incomplete or inaccurate the data submitted under paragraph (d) of this clause, the Contractor shall promptly notify the Contracting Officer and resubmit the data.

(f) Neither the requirements of this clause nor any act or failure to act by the Government shall relieve the Contractor of any responsibility or liability for the safety of Government, Contractor, or subcontractor personnel or property.

(g) Nothing contained in this clause shall relieve the Contractor from complying with applicable Federal, State, and local laws, codes, ordinances, and regulations (including the obtaining of licenses and permits) in connection with hazardous material.

(h) The Government's rights in data furnished under this contract with respect to hazardous material are as follows:

(1) To use, duplicate and disclose any data to which this clause is applicable. The purposes of this right are to--

(i) Apprise personnel of the hazards to which they may be exposed in using, handling, packaging, transporting, or disposing of hazardous materials;

(ii) Obtain medical treatment for those affected by the material; and



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(iii) Have others use, duplicate, and disclose the data for the Government for these purposes.

(2) To use, duplicate, and disclose data furnished under this clause, in accordance with subparagraph (h)(1) of this clause, in precedence over any other clause of this contract providing for rights in data.

(3) The Government is not precluded from using similar or identical data acquired from other sources.

(i) Except as provided in paragraph (i)(2) the Contractor shall prepare and submit a sufficient number of Material Safety Data Sheets (MSDS's), meeting the requirements of 29 CFR 1910.1200(g) and the latest version of Federal Standard No. 313, for all hazardous materials identified in paragraph (b) of this clause.

(1) For items shipped to consignees, the Contractor shall include a copy of the MSDS with the packing list or other suitable shipping document which accompanies each shipment. Alternatively, the Contractor is permitted to transmit MSDS's to consignees in advance of receipt of shipments by consignees, if authorized in writing by the Contracting Officer.

(2) For items shipped to consignees identified by mailing address as agency depots, distribution centers or customer supply centers, the Contractor shall provide one copy of the MSDS's in or on each shipping container. If affixed to the outside of each container, the MSDS must be placed in a weather resistant envelope.

(End of Clause)

#### **4.8 52.225-11 BUY AMERICAN ACT--CONSTRUCTION MATERIALS UNDER TRADE AGREEMENTS (NOV 2012)**

(a) *Definitions.* As used in this clause--

"Caribbean Basin country construction material" means a construction material that--

(1) Is wholly the growth, product, or manufacture of a Caribbean Basin country; or

(2) In the case of a construction material that consists in whole or in part of materials from another country, has been substantially transformed in a Caribbean Basin country into a new and different construction material distinct from the materials from which it was transformed.

"Commercially available off-the-shelf (COTS) item"-- (1) Means any item of supply (including construction material) that is--

(i) A commercial item (as defined in paragraph (1) of the definition at FAR 2.101);

(ii) Sold in substantial quantities in the commercial marketplace; and

(iii) Offered to the Government, under a contract or subcontract at any tier, without modification, in the same form in which it is sold in the commercial marketplace; and

(2) Does not include bulk cargo, as defined in section 3 of the Shipping Act of 1984 (46 U.S.C. App. 1702), such as agricultural products and petroleum products.

"Component" means an article, material, or supply incorporated directly into a construction material.

"Construction material" means an article, material, or supply brought to the construction site by the Contractor or subcontractor for incorporation into the building or work. The term also includes an item brought to the site preassembled from articles, materials, or supplies. However, emergency life safety systems, such as emergency lighting, fire alarm, and

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audio evacuation systems, that are discrete systems incorporated into a public building or work and that are produced as complete systems, are evaluated as a single and distinct construction material regardless of when or how the individual parts or components of those systems are delivered to the construction site. Materials purchased directly by the Government are supplies, not construction material.

"Cost of components" means--

(1) For components purchased by the Contractor, the acquisition cost, including transportation costs to the place of incorporation into the construction material (whether or not such costs are paid to a domestic firm), and any applicable duty (whether or not a duty-free entry certificate is issued); or

(2) For components manufactured by the Contractor, all costs associated with the manufacture of the component, including transportation costs as described in paragraph (1) of this definition, plus allocable overhead costs, but excluding profit. Cost of components does not include any costs associated with the manufacture of the construction material.

"Designated country" means any of the following countries:

(1) A World Trade Organization Government Procurement Agreement country (Armenia, Aruba, Austria, Belgium, Bulgaria, Canada, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hong Kong, Hungary, Iceland, Ireland, Israel, Italy, Japan, Korea (Republic of), Latvia, Liechtenstein, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Singapore, Slovak Republic, Slovenia, Spain, Sweden, Switzerland, Taiwan, or United Kingdom);

(2) A Free Trade Agreement country (Australia, Bahrain, Canada, Chile, Colombia, Costa Rica, Dominican Republic, El Salvador, Guatemala, Honduras, Korea (Republic of), Mexico, Morocco, Nicaragua, Oman, Panama, Peru, or Singapore);

(3) A least developed country (Afghanistan, Angola, Bangladesh, Benin, Bhutan, Burkina Faso, Burundi, Cambodia, Central African Republic, Chad, Comoros, Democratic Republic of Congo, Djibouti, East Timor, Equatorial Guinea, Eritrea, Ethiopia, Gambia, Guinea, Guinea-Bissau, Haiti, Kiribati, Laos, Lesotho, Liberia, Madagascar, Malawi, Maldives, Mali, Mauritania, Mozambique, Nepal, Niger, Rwanda, Samoa, Sao Tome and Principe, Senegal, Sierra Leone, Solomon Islands, Somalia, Tanzania, Togo, Tuvalu, Uganda, Vanuatu, Yemen, or Zambia); or

(4) A Caribbean Basin country (Antigua and Barbuda, Aruba, Bahamas, Barbados, Belize, Bonaire, British Virgin Islands, Curacao, Dominica, Grenada, Guyana, Haiti, Jamaica, Montserrat, Saba, St. Kitts and Nevis, St. Lucia, St. Vincent and the Grenadines, Sint Eustatius, Sint Maarten, or Trinidad and Tobago).

"Designated country construction material" means a construction material that is a WTO GPA country construction material, an FTA country construction material, a least developed country construction material, or a Caribbean Basin country construction material.

"Domestic construction material" means--

(1) An unmanufactured construction material mined or produced in the United States;

(2) A construction material manufactured in the United States, if--

(i) The cost of its components mined, produced, or manufactured in the United States exceeds 50 percent of the cost of all its components. Components of foreign origin of the same class or kind for which nonavailability determinations have been made are treated as domestic; or

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(ii) The construction material is a COTS item.

"Foreign construction material" means a construction material other than a domestic construction material.

"Free Trade Agreement country construction material" means a construction material that--

(1) Is wholly the growth, product, or manufacture of a Free Trade Agreement (FTA) country; or

(2) In the case of a construction material that consists in whole or in part of materials from another country, has been substantially transformed in a FTA country into a new and different construction material distinct from the materials from which it was transformed.

"Least developed country construction material" means a construction material that--

(1) Is wholly the growth, product, or manufacture of a least developed country; or

(2) In the case of a construction material that consists in whole or in part of materials from another country, has been substantially transformed in a least developed country into a new and different construction material distinct from the materials from which it was transformed.

"United States" means the 50 States, the District of Columbia, and outlying areas.

"WTO GPA country construction material" means a construction material that--

(1) Is wholly the growth, product, or manufacture of a WTO GPA country; or

(2) In the case of a construction material that consists in whole or in part of materials from another country, has been substantially transformed in a WTO GPA country into a new and different construction material distinct from the materials from which it was transformed.

(b) Construction materials.

(1) This clause implements the Buy American Act (41 U.S.C. chapter 83) by providing a preference for domestic construction material. In accordance with 41 U.S.C. 1907, the component test of the Buy American Act is waived for construction material that is a COTS item (See FAR 12.505(a)(2)). In addition, the Contracting Officer has determined that the WTO GPA and Free Trade Agreements (FTAs) apply to this acquisition. Therefore, the Buy American Act restrictions are waived for designated country construction materials.

(2) The Contractor shall use only domestic or designated country construction material in performing this contract, except as provided in paragraphs (b)(3) and (b)(4) of this clause.

(3) The requirement in paragraph (b)(2) of this clause does not apply to information technology that is a commercial item or to the construction materials or components listed by the Government as follows:

Lead Glass

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(4) The Contracting Officer may add other foreign construction material to the list in paragraph (b)(3) of this clause if the Government determines that--

(i) The cost of domestic construction material would be unreasonable. The cost of a particular domestic construction material subject to the restrictions of the Buy American Act is unreasonable when the cost of such material exceeds the cost of foreign material by more than 6 percent;

(ii) The application of the restriction of the Buy American Act to a particular construction material would be impracticable or inconsistent with the public interest; or

(iii) The construction material is not mined, produced, or manufactured in the United States in sufficient and reasonably available commercial quantities of a satisfactory quality.

(c) Request for determination of inapplicability of the Buy American Act.

(1)(i) Any Contractor request to use foreign construction material in accordance with paragraph (b)(4) of this clause shall include adequate information for Government evaluation of the request, including--

(A) A description of the foreign and domestic construction materials;

(B) Unit of measure;

(C) Quantity;

(D) Price;

(E) Time of delivery or availability;

(F) Location of the construction project;

(G) Name and address of the proposed supplier; and

(H) A detailed justification of the reason for use of foreign construction materials cited in accordance with paragraph (b)(3) of this clause.

(ii) A request based on unreasonable cost shall include a reasonable survey of the market and a completed price comparison table in the format in paragraph (d) of this clause.

(iii) The price of construction material shall include all delivery costs to the construction site and any applicable duty (whether or not a duty-free certificate may be issued).

(iv) Any Contractor request for a determination submitted after contract award shall explain why the Contractor could not reasonably foresee the need for such determination and could not have requested the determination before contract award. If the Contractor does not submit a satisfactory explanation, the Contracting Officer need not make a determination.

(2) If the Government determines after contract award that an exception to the Buy American Act applies and the Contracting Officer and the Contractor negotiate adequate consideration, the Contracting Officer will modify the contract to allow use of the foreign construction material. However, when the basis for the exception is the unreasonable price of a domestic construction material, adequate consideration is not less than the differential established in paragraph (b)(4)(i) of this clause.

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(3) Unless the Government determines that an exception to the Buy American Act applies, use of foreign construction material is noncompliant with the Buy American Act.

(d) *Data*. To permit evaluation of requests under paragraph (c) of this clause based on unreasonable cost, the Contractor shall include the following information and any applicable supporting data based on the survey of suppliers:

## Foreign and Domestic Construction Materials Price Comparison

Construction Material Description	Unit of Measure	Quantity	Price (Dollars)*
Item 1:			
Foreign Construction Material			
Domestic Construction Material			
Item 2:			
Foreign Construction Material			
Domestic Construction Material			

[List name, address, telephone number, and contact for suppliers surveyed. Attach copy of response; if oral, attach summary.]

[Include other applicable supporting information.]

[\* Include all delivery costs to the construction site and any applicable duty (whether or not a duty-free entry certificate is issued).]

(End of Clause)

#### 4.9 SUPPLEMENTAL INSURANCE REQUIREMENTS

In accordance with FAR 28.307-2 and FAR 52.228-5, the following minimum coverage shall apply to this contract:

(a) Workers' compensation and employers liability: Contractors are required to comply with applicable Federal and State workers' compensation and occupational disease statutes. If occupational diseases are not compensable under those statutes, they shall be covered under the employer's liability section of the insurance policy, except when contract operations are so commingled with a Contractor's commercial operations that it would not be practical to require this coverage. Employer's liability coverage of at least \$100,000 is required, except in States with exclusive or monopolistic funds that do not permit workers' compensation to be written by private carriers.

(b) General Liability: \$500,000.00 per occurrences.

(c) Automobile liability: \$200,000.00 per person; \$500,000.00 per occurrence and \$20,000.00 property damage.

(d) The successful bidder must present to the Contracting Officer, prior to award, evidence of general liability insurance without any exclusionary clauses for asbestos that would void the general liability coverage.

(End of Clause)

#### 4.10 52.232-99 PROVIDING ACCELERATED PAYMENT TO SMALL BUSINESS SUBCONTRACTORS (DEVIATION) (AUG 2012)

This clause implements the temporary policy provided by OMB Policy Memorandum M-12-16, Providing Prompt Payment to Small Business Subcontractors, dated July 11, 2012.

(a) Upon receipt of accelerated payments from the Government, the contractor is required to make accelerated payments to small business subcontractors to the maximum extent practicable after receipt of a proper invoice and all proper documentation from the small business subcontractor.

- (b) Include the substance of this clause, including this paragraph (b), in all subcontracts with small business concerns.
- (c) The acceleration of payments under this clause does not provide any new rights under the Prompt Payment Act.

(End of Clause)

#### **4.11 52.236-1 PERFORMANCE OF WORK BY THE CONTRACTOR (APR 1984)**

The Contractor shall perform on the site, and with its own organization, work equivalent to at least 15 percent of the total amount of work to be performed under the contract. This percentage may be reduced by a supplemental agreement to this contract if, during performing the work, the Contractor requests a reduction and the Contracting Officer determines that the reduction would be to the advantage of the Government.

(End of Clause)

#### **4.12 52.236-4 PHYSICAL DATA (APR 1984)**

Data and information furnished or referred to below is for the Contractor's information. The Government shall not be responsible for any interpretation of or conclusion drawn from the data or information by the Contractor.

- (a) The indications of physical conditions on the drawings and in the specifications are the result of site investigations by:

Cannon Design  
360 Madison Avenue 11th Floor  
New York City, New York 10017  
Phone: 646-862-7562  
cannondesign.com

- (b) Weather Conditions:

N/A

- (c) Transportation Facilities

N/A

- (d) Other Physical Data

N/A

(End of Clause)

**4.13 52.252-2 CLAUSES INCORPORATED BY REFERENCE (FEB 1998)**

This contract incorporates one or more clauses by reference, with the same force and effect as if they were given in full text. Upon request, the Contracting Officer will make their full text available. Also, the full text of a clause may be accessed electronically at this/these address(es):

<http://www.acquisition.gov/far/index.html>

<http://www.va.gov/oal/library/vaar/>

(End of Clause)

<b><u>FAR</u></b> <b><u>Number</u></b>	<b><u>Title</u></b>	<b><u>Date</u></b>
52.202-1	DEFINITIONS	JAN 2012
52.203-3	GRATUITIES	APR 1984
52.203-5	COVENANT AGAINST CONTINGENT FEES	APR 1984
52.203-6	RESTRICTIONS ON SUBCONTRACTOR SALES TO THE GOVERNMENT	SEP 2006
52.203-7	ANTI-KICKBACK PROCEDURES	OCT 2010
52.203-8	CANCELLATION, RESCISSION, AND RECOVERY OF FUNDS FOR ILLEGAL OR IMPROPER ACTIVITY	JAN 1997
52.203-10	PRICE OR FEE ADJUSTMENT FOR ILLEGAL OR IMPROPER ACTIVITY	JAN 1997
52.203-12	LIMITATION ON PAYMENTS TO INFLUENCE CERTAIN FEDERAL TRANSACTIONS	OCT 2010
52.203-13	CONTRACTOR CODE OF BUSINESS ETHICS AND CONDUCT	APR 2010
52.204-4	PRINTED OR COPIED DOUBLE-SIDED ON RECYCLED PAPER	MAY 2011
52.204-9	PERSONAL IDENTITY VERIFICATION OF CONTRACTOR PERSONNEL	JAN 2011
52.204-10	REPORTING EXECUTIVE COMPENSATION AND FIRST-TIER SUBCONTRACT AWARDS	AUG 2012
52.204-12	DATA UNIVERSAL NUMBERING SYSTEM NUMBER MAINTENANCE	DEC 2012
52.209-6	PROTECTING THE GOVERNMENT'S INTEREST WHEN SUBCONTRACTING WITH CONTRACTORS DEBARRED, SUSPENDED, OR PROPOSED FOR DEBARMENT	DEC 2010
52.210-1	MARKET RESEARCH	APR 2011
<b><u>FAR</u></b> <b><u>Number</u></b>	<b><u>Title</u></b>	<b><u>Date</u></b>
52.215-2	AUDIT AND RECORDS--NEGOTIATION	OCT 2010

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52.219-4	NOTICE OF PRICE EVALUATION PREFERENCE FOR HUBZONE SMALL BUSINESS CONCERNS ALTERNATE I (JAN 2011)	JAN 2011
52.219-8	UTILIZATION OF SMALL BUSINESS CONCERNS	JAN 2011
52.219-9	SMALL BUSINESS SUBCONTRACTING PLAN ALTERNATE II (OCT 2001)	JAN 2011
52.219-16	LIQUIDATED DAMAGES--SUBCONTRACTING PLAN	JAN 1999
52.219-25	SMALL DISADVANTAGED BUSINESS PARTICIPATION PROGRAM--DISADVANTAGED STATUS AND REPORTING	DEC 2010
52.222-1	NOTICE TO THE GOVERNMENT OF LABOR DISPUTES	FEB 1997
52.222-3	CONVICT LABOR	JUN 2003
52.222-4	CONTRACT WORK HOURS AND SAFETY STANDARDS ACT-OVERTIME COMPENSATION	JUL 2005
52.222-6	DAVIS-BACON ACT	JUL 2005
52.222-7	WITHHOLDING OF FUNDS	FEB 1988
52.222-8	PAYROLLS AND BASIC RECORDS	JUN 2010
52.222-9	APPRENTICES AND TRAINEES	JUL 2005
52.222-10	COMPLIANCE WITH COPELAND ACT REQUIREMENTS	FEB 1988
52.222-11	SUBCONTRACTS (LABOR STANDARDS)	JUL 2005
52.222-12	CONTRACT TERMINATION - DEBARMENT	FEB 1988
52.222-13	COMPLIANCE WITH DAVIS-BACON AND RELATED ACT REGULATIONS	FEB 1988
52.222-14	DISPUTES CONCERNING LABOR STANDARDS	FEB 1988
52.222-15	CERTIFICATION OF ELIGIBILITY	FEB 1988
52.222-21	PROHIBITION OF SEGREGATED FACILITIES	FEB 1999
52.222-26	EQUAL OPPORTUNITY	MAR 2007
52.222-27	AFFIRMATIVE ACTION COMPLIANCE REQUIREMENTS FOR CONSTRUCTION	FEB 1999
52.222-35	EQUAL OPPORTUNITY FOR VETERANS	SEP 2010
52.222-36	AFFIRMATIVE ACTION FOR WORKERS WITH DISABILITIES	OCT 2010
52.222-37	EMPLOYMENT REPORTS ON VETERANS	SEP 2010
52.222-50	COMBATING TRAFFICKING IN PERSONS	FEB 2009
52.222-54	EMPLOYMENT ELIGIBILITY VERIFICATION	JUL 2012
52.223-5	POLLUTION PREVENTION AND RIGHT-TO-KNOW INFORMATION	MAY 2011
52.223-6	DRUG-FREE WORKPLACE	MAY 2001
52.223-18	ENCOURAGING CONTRACTOR POLICIES TO BAN TEXT MESSAGING WHILE DRIVING	AUG 2011
52.225-13	RESTRICTIONS ON CERTAIN FOREIGN PURCHASES	JUN 2008
52.227-1	AUTHORIZATION AND CONSENT	DEC 2007



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52.227-2	NOTICE AND ASSISTANCE REGARDING PATENT AND COPYRIGHT INFRINGEMENT	DEC 2007
52.227-4	PATENT INDEMNITY--CONSTRUCTION CONTRACTS	DEC 2007
52.228-2	ADDITIONAL BOND SECURITY	OCT 1997
52.228-5	INSURANCE--WORK ON A GOVERNMENT INSTALLATION	JAN 1997
52.228-11	PLEDGES OF ASSETS	JAN 2012
52.228-12	PROSPECTIVE SUBCONTRACTOR REQUESTS FOR BONDS	OCT 1995
52.228-14	IRREVOCABLE LETTER OF CREDIT	DEC 1999
52.228-15	PERFORMANCE AND PAYMENT BONDS-- CONSTRUCTION	OCT 2010
52.229-3	FEDERAL, STATE, AND LOCAL TAXES	FEB 2013
52.232-5	PAYMENTS UNDER FIXED-PRICE CONSTRUCTION CONTRACTS	SEP 2002
52.232-17	INTEREST	OCT 2010
52.232-23	ASSIGNMENT OF CLAIMS	JAN 1986
52.232-27	PROMPT PAYMENT FOR CONSTRUCTION CONTRACTS	OCT 2008
52.232-34	PAYMENT BY ELECTRONIC FUNDS TRANSFER-- OTHER THAN CENTRAL CONTRACTOR REGISTRATION	MAY 1999
52.233-1	DISPUTES ALTERNATE I (DEC 1991)	JUL 2002
52.233-3	PROTEST AFTER AWARD	AUG 1996
52.233-4	APPLICABLE LAW FOR BREACH OF CONTRACT CLAIM	OCT 2004
52.236-2	DIFFERING SITE CONDITIONS	APR 1984
52.236-3	SITE INVESTIGATION AND CONDITIONS AFFECTING THE WORK	APR 1984
52.236-5	MATERIAL AND WORKMANSHIP	APR 1984
52.236-6	SUPERINTENDENCE BY THE CONTRACTOR	APR 1984
52.236-7	PERMITS AND RESPONSIBILITIES	NOV 1991
52.236-8	OTHER CONTRACTS	APR 1984
52.236-9	PROTECTION OF EXISTING VEGETATION, STRUCTURES, EQUIPMENT, UTILITIES, AND IMPROVEMENTS	APR 1984
52.236-10	OPERATIONS AND STORAGE AREAS	APR 1984
52.236-11	USE AND POSSESSION PRIOR TO COMPLETION	APR 1984
52.236-12	CLEANING UP	APR 1984
52.236-13	ACCIDENT PREVENTION	NOV 1991
52.236-14	AVAILABILITY AND USE OF UTILITY SERVICES	APR 1984
52.236-15	SCHEDULES FOR CONSTRUCTION CONTRACTS	APR 1984
52.236-16	QUANTITY SURVEYS	APR 1984

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52.236-17	LAYOUT OF WORK	APR 1984
52.236-21	SPECIFICATIONS AND DRAWINGS FOR CONSTRUCTION ALTERNATE I (APR 1984)	FEB 1997
52.236-26	PRECONSTRUCTION CONFERENCE	FEB 1995
52.242-13	BANKRUPTCY	JUL 1995
52.242-14	SUSPENSION OF WORK	APR 1984
52.243-4	CHANGES	JUN 2007
52.244-5	COMPETITION IN SUBCONTRACTING	DEC 1996
52.244-6	SUBCONTRACTS FOR COMMERCIAL ITEMS	DEC 2010
52.245-1	GOVERNMENT PROPERTY	APR 2012
52.245-9	USE AND CHARGES	APR 2012
52.246-12	INSPECTION OF CONSTRUCTION	AUG 1996
52.246-21	WARRANTY OF CONSTRUCTION ALTERNATE I (APR 1984)	MAR 1994
52.248-3	VALUE ENGINEERING--CONSTRUCTION	OCT 2010
52.249-2	TERMINATION FOR CONVENIENCE OF THE GOVERNMENT (FIXED PRICE) ALTERNATE I (SEPT 1996)	APR 2012
52.249-10	DEFAULT (FIXED-PRICE CONSTRUCTION)	APR 1984
52.253-1	COMPUTER GENERATED FORMS	JAN 1991

**4.14 VAAR 852.203-70 COMMERCIAL ADVERTISING (JAN 2008)**

The bidder or offeror agrees that if a contract is awarded to him/her, as a result of this solicitation, he/she will not advertise the award of the contract in his/her commercial advertising in such a manner as to state or imply that the Department of Veterans Affairs endorses a product, project or commercial line of endeavor.

(End of Clause)

**4.15 VAAR 852.203-71 DISPLAY OF DEPARTMENT OF VETERAN AFFAIRS HOTLINE POSTER (DEC 1992)**

(a) Except as provided in paragraph (c) below, the Contractor shall display prominently, in common work areas within business segments performing work under VA contracts, Department of Veterans Affairs Hotline posters prepared by the VA Office of Inspector General.

(b) Department of Veterans Affairs Hotline posters may be obtained from the VA Office of Inspector General (53E), P.O. Box 34647, Washington, DC 20043-4647.

(c) The Contractor need not comply with paragraph (a) above if the Contractor has established a mechanism, such as a hotline, by which employees may report suspected instances of improper conduct, and instructions that encourage employees to make such reports.

(End of Clause)

**4.16 VAAR 852.211-74 LIQUIDATED DAMAGES (JAN 2008)**

If any unit of the work contracted for is accepted in advance of the whole, the rate of liquidated damages assessed will be in the ratio that the value of the unaccepted work bears to the total amount of the contract. If a separate price for

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unaccepted work has not been stated in the contractor's bid, determination of the value thereof will be made from schedules of costs furnished by the contractor and approved by the contracting officer, as specified elsewhere in the contract.

(End of Clause)

**4.17 852.211-75 PRODUCT SPECIFICATIONS (JAN 2008)**

The products offered under this solicitation shall be type , grade , in accordance with No. , dated and amendment dated , except for paragraphs and which are amended as follows:

Fire Alarm – Honeywell Notifier System

Building Management System – Automated Logic

Security System – Hirsh

Electrical Equipment Monitoring – Square D with the PowerLogic Monitoring

Nurse Call – Hill-Rom

(End of Clause)

**4.18 VAAR 852.215-71 EVALUATION FACTOR COMMITMENTS (DEC 2009)**

The offeror agrees, if awarded a contract, to use the service-disabled veteran-owned small businesses or veteran-owned small businesses proposed as subcontractors in accordance with 852.215-70, Service-Disabled Veteran-Owned and Veteran-Owned Small Business Evaluation Factors, or to substitute one or more service-disabled veteran-owned small businesses or veteran-owned small businesses for subcontract work of the same or similar value.

(End of Clause)

**4.19 VAAR 852.219-9 VA SMALL BUSINESS SUBCONTRACTING PLAN MINIMUM REQUIREMENTS (DEC 2009)**

(a) This clause does not apply to small business concerns.

(b) If the offeror is required to submit an individual subcontracting plan, the minimum goals for award of subcontracts to service-disabled veteran-owned small business concerns and veteran-owned small business concerns shall be at least commensurate with the Department's annual service-disabled veteran-owned small business and veteran-owned small business prime contracting goals for the total dollars planned to be subcontracted.

(c) For a commercial plan, the minimum goals for award of subcontracts to service-disabled veteran-owned small business concerns and veteran-owned small businesses shall be at least commensurate with the Department's annual service-disabled veteran-owned small business and veteran-owned small business prime contracting goals for the total value of projected subcontracts to support the sales for the commercial plan.

(d) To be credited toward goal achievements, businesses must be verified as eligible in the Vendor Information Pages database. The contractor shall annually submit a listing of service-disabled veteran-owned small businesses and veteran-owned small businesses for which credit toward goal achievement is to be applied for the review of personnel in the Office of Small and Disadvantaged Business Utilization.

(e) The contractor may appeal any businesses determined not eligible for crediting toward goal achievements by following the procedures contained in 819.407.

(End of Clause)

**4.20 VAAR 852.228-70 BOND PREMIUM ADJUSTMENT (JAN 2008)**

When net changes in original contract price affect the premium of a Corporate Surety Bond by \$5 or more, the Government, in determining the basis for final settlement, will provide for bond premium adjustment computed at the rate shown in the bond.

(End of Clause)

**4.21 852.232-72 ELECTRONIC SUBMISSION OF PAYMENT REQUESTS (NOV 2012)**

(a) *Definitions.* As used in this clause—

(1) *Contract financing payment* has the meaning given in FAR 32.001.

(2) *Designated agency office* has the meaning given in 5 CFR 1315.2(m).

(3) *Electronic form* means an automated system transmitting information electronically according to the

Accepted electronic data transmission methods and formats identified in paragraph (c) of this clause. Facsimile, email, and scanned documents are not acceptable electronic forms for submission of payment requests.

(4) *Invoice payment* has the meaning given in FAR 32.001.

(5) *Payment request* means any request for contract financing payment or invoice payment submitted by the contractor under this contract.

(b) *Electronic payment requests.* Except as provided in paragraph (e) of this clause, the contractor shall submit payment requests in electronic form. Purchases paid with a Government-wide commercial purchase card are considered to be an electronic transaction for purposes of this rule, and therefore no additional electronic invoice submission is required.

(c) *Data transmission.* A contractor must ensure that the data transmission method and format are through one of the following:

(1) VA's Electronic Invoice Presentment and Payment System. (See Web site at <http://www.fsc.va.gov/einvoice.asp>.)

(2) Any system that conforms to the X12 electronic data interchange (EDI) formats established by the Accredited Standards Center (ASC) and chartered by the American National Standards Institute (ANSI). The X12 EDI Web site (<http://www.x12.org>) includes additional information on EDI 810 and 811 formats.

(d) *Invoice requirements.* Invoices shall comply with FAR 32.905.

(e) *Exceptions.* If, based on one of the circumstances below, the contracting officer directs that payment requests be made by mail, the contractor shall submit payment requests by mail through the United States Postal Service to the designated agency office. Submission of payment requests by mail may be required for:

(1) Awards made to foreign vendors for work performed outside the United States;

(2) Classified contracts or purchases when electronic submission and processing of payment requests could compromise the safeguarding of classified or privacy information;

(3) Contracts awarded by contracting officers in the conduct of emergency operations, such as responses to national emergencies;

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(4) Solicitations or contracts in which the designated agency office is a VA entity other than the VA Financial Services Center in Austin, Texas; or

(5) Solicitations or contracts in which the VA designated agency office does not have electronic invoicing capability as described above.

(End of Clause)

**4.22 VAAR 852.236-71 SPECIFICATIONS AND DRAWINGS FOR CONSTRUCTION (JUL 2002)**

The clause entitled "Specifications and Drawings for Construction" in FAR 52.236-21 is supplemented as follows:

(a) The contracting officer's interpretation of the drawings and specifications will be final, subject to the disputes clause.

(b) Large scale drawings supersede small scale drawings.

(c) Dimensions govern in all cases. Scaling of drawings may be done only for general location and general size of items.

(d) Dimensions shown of existing work and all dimensions required for work that is to connect with existing work shall be verified by the contractor by actual measurement of the existing work. Any work at variance with that specified or shown in the drawings shall not be performed by the contractor until approved in writing by the contracting officer.

(End of Clause)

**4.23 VAAR 852.236-72 PERFORMANCE OF WORK BY THE CONTRACTOR (JUL 2002)  
ALTERNATE I**

The clause entitled "Performance of Work by the Contractor" in FAR 52.236-1 is supplemented as follows:

(a) Contract work accomplished on the site by laborers, mechanics, and foremen/forewomen on the contractor's payroll and under his/her direct supervision shall be included in establishing the percent of work to be performed by the contractor. Cost of material and equipment installed by such labor may be included. The work by the contractor's executive, supervisory and clerical forces shall be excluded in establishing compliance with the requirements of this clause.

(b) The contractor shall submit, simultaneously with the cost per activity of the construction schedule required by Section 01310 or 01311, NETWORK ANALYSIS SYSTEM, a responsibility code for all activities of the network for which the contractor's forces will perform the work. The cost of these activities will be used in determining the portions of the total contract work to be executed by the contractor's forces for the purpose of this article.

(c) If, during progress of work hereunder, the contractor requests a change in activities of work to be performed by the contractor's forces and the contracting officer determines it to be in the best interest of the Government, the contracting officer may, at his or her discretion, authorize a change in such activities of said work.

(d) In the event the contractor fails or refuses to meet the requirement of the FAR clause at 52.236-1, it is expressly agreed that the contract price will be reduced by 15 percent of the value of that portion of the percentage requirement that is accomplished by others. For the purpose of this clause, it is agreed that 15 percent is an acceptable estimate of the contractor's overhead and profit, or mark-up, on that portion of the work which the contractor fails or refuses to perform, with his/her own forces, in accordance with the FAR clause at 52.236-1.

(End of Clause)

**4.24 VAAR 852.236-74 INSPECTION OF CONSTRUCTION (JUL 2002)**

The clause entitled "Inspection of Construction" in FAR 52.246-12 is supplemented as follows:

(a) Inspection of materials and articles furnished under this contract will be made at the site by the resident engineer, unless otherwise provided for in the specifications.

(b) Final inspection will not be made until the contract work is ready for beneficial use or occupancy. The contractor shall notify the contracting officer, through the resident engineer, fifteen (15) days prior to the date on which the work will be ready for final inspection.

(End of Clause)

**4.25 VAAR 852.236-76 CORRESPONDENCE (APR 1984)**

All correspondence relative to this contract shall bear Specification Number, Project Number, Department of Veterans Affairs Contract Number, title of project and name of facility.

(End of Clause)

**4.26 VAAR 852.236-77 REFERENCE TO "STANDARDS" (JUL 2002)**

Any materials, equipment, or workmanship specified by references to number, symbol, or title of any specific Federal, Industry or Government Agency Standard Specification shall comply with all applicable provisions of such standard specifications, except as limited to type, class or grade, or modified in contract specifications. Reference to "Standards" referred to in the contract specifications, except as modified, shall have full force and effect as though printed in detail in specifications.

(End of Clause)

**4.27 VAAR 852.236-78 GOVERNMENT SUPERVISION (APR 1984)**

(a) The work will be under the direction of the Department of Veterans Affairs contracting officer, who may designate another VA employee to act as resident engineer at the construction site.

(b) Except as provided below, the resident engineer's directions will not conflict with or change contract requirements.

(c) Within the limits of any specific authority delegated by the contracting officer, the resident engineer may, by written direction, make changes in the work. The contractor shall be advised of the extent of such authority prior to execution of any work under the contract.

(End of Clause)

**4.28 VAAR 852.236-79 DAILY REPORT OF WORKERS AND MATERIAL (APR 1984)**

The contractor shall furnish to the resident engineer each day a consolidated report for the preceding work day in which is shown the number of laborers, mechanics, foremen/forewomen and pieces of heavy equipment used or employed by the contractor and subcontractors. The report shall bear the name of the firm, the branch of work which they perform such as concrete, plastering, masonry, plumbing, sheet metal work, etc. The report shall give a breakdown of employees by crafts, location where employed, and work performed. The report shall also list materials delivered to the site on the date covered by the report.

(End of Clause)

#### **4.29 VAAR 852.236-80 SUBCONTRACTS AND WORK COORDINATION (APR 1984) ALTERNATE I (JUL 2002)**

(a) Nothing contained in this contract shall be construed as creating any contractual relationship between any subcontractor and the Government. Divisions or sections of specifications are not intended to control the contractor in dividing work among subcontractors, or to limit work performed by any trade.

(b) The contractor shall be responsible to the Government for acts and omissions of his/her own employees, and subcontractors and their employees. The contractor shall also be responsible for coordination of the work of the trades, subcontractors, and material suppliers. The contractor shall, in advance of the work, prepare coordination drawings showing the location of openings through slabs, the pipe sleeves and hanger inserts, as well as the location and elevation of utility lines, including, but not limited to, conveyor systems, pneumatic tubes, ducts, and conduits and pipes 2 inches and larger in diameter. These drawings, including plans, elevations, and sections as appropriate shall clearly show the manner in which the utilities fit into the available space and relate to each other and to existing building elements. Drawings shall be of appropriate scale to satisfy the previously stated purposes, but not smaller than 3/8-inch scale. Drawings may be composite (with distinctive colors for the various trades) or may be separate but fully coordinated drawings (such as sepias or photographic paper reproductions) of the same scale. Separate drawings shall depict identical building areas or sections and shall be capable of being overlaid in any combination. The submitted drawings for a given area of the project shall show the work of all trades which will be involved in that particular area. Six complete composite drawings or six complete sets of separate reproducible drawings shall be received by the Government not less than 20 days prior to the scheduled start of the work in the area illustrated by the drawings, for the purpose of showing the contractor's planned methods of installation. The objectives of such drawings are to promote carefully planned work sequence and proper trade coordination, in order to assure the expeditious solutions of problems and the installation of lines and equipment as contemplated by the contract documents while avoiding or minimizing additional costs to the contractor and to the Government. In the event the contractor, in coordinating the various installations and in planning the method of installation, finds a conflict in location or elevation of any of the utilities with themselves, with structural items or with other construction items, he/she shall bring this conflict to the attention of the contracting officer immediately. In doing so, the contractor shall explain the proposed method of solving the problem or shall request instructions as to how to proceed if adjustments beyond those of usual trades coordination are necessary. Utilities installation work will not proceed in any area prior to the submission and completion of the Government review of the coordinated drawings for that area, nor in any area in which conflicts are disclosed by the coordination drawings until the conflicts have been corrected to the satisfaction of the contracting officer. It is the responsibility of the contractor to submit the required drawings in a timely manner consistent with the requirements to complete the work covered by this contract within the prescribed contract time.

(c) The Government or its representatives will not undertake to settle any differences between the contractor and subcontractors or between subcontractors.

(d) The Government reserves the right to refuse to permit employment on the work or require dismissal from the work of any subcontractor who, by reason of previous unsatisfactory work on Department of Veterans Affairs projects or for any other reason, is considered by the contracting officer to be incompetent or otherwise objectionable.

(End of Clause)

#### **4.30 VAAR 852.236-83 PAYMENTS UNDER FIXED-PRICE CONSTRUCTION CONTRACTS (INCLUDING NAS) (JUL 2002) ALTERNATE I (JUL 2002)**

The clause entitled "Payments under Fixed-Price Construction Contracts" in FAR 52.232-5 is implemented as follows:

(a) Retainage:



**Renovation of the 9<sup>th</sup> Floor of Building 1 - Manhattan, NY**

(1) The contracting officer may retain funds:

(i) Where the performance under the contract has been determined to be deficient or the contractor has performed in an unsatisfactory manner in the past; or

(ii) As the contract nears completion, to ensure that deficiencies will be corrected and that completion is timely.

(2) Examples of deficient performance justifying a retention of funds include, but are not restricted to, the following:

(i) Unsatisfactory progress as determined by the contracting officer;

(ii) Failure either to meet schedules in Section Network Analysis System (NAS), or to process the Interim Arrow Diagram/Complete Project Arrow Diagram;

(iii) Failure to present submittals in a timely manner; or

(iv) Failure to comply in good faith with approved subcontracting plans, certifications or contract requirements.

(3) Any level of retention shall not exceed 10 percent either where there is determined to be unsatisfactory performance, or when the retainage is to ensure satisfactory completion. Retained amounts shall be paid promptly upon completion of all contract requirements, but nothing contained in this subparagraph shall be construed as limiting the contracting officer's right to withhold funds under other provisions of the contract or in accordance with the general law and regulations regarding the administration of Government contracts.

(b) The contractor shall submit a schedule of costs in accordance with the requirements of Section Network Analysis System (NAS) to the contracting officer for approval within 90 calendar days after date of receipt of notice to proceed. The approved cost schedule will be one of the bases for determining progress payments to the contractor for work completed.

(1) Costs as shown on this schedule must be true costs and, should the resident engineer so desire, he/she may require the contractor to submit his/her original estimate sheets or other information to substantiate the detailed makeup of the cost schedule.

(2) The total costs of all activities shall equal the contract price.

(3) Insurance and similar items shall be prorated and included in each activity cost of the critical path method (CPM) network.

(4) The CPM network shall include a separate cost loaded activity for adjusting and testing of the systems listed below. The percentages listed below will be used to determine the cost of adjust and test activities and identify, for payment purposes, the value of the work to adjust, correct and test systems after the material has been installed.

(5) Payment for adjust and test activities will be made only after the contractor has demonstrated that each of the systems is substantially complete and operates as required by the contract.

(6)(i) The contractor shall show on the critical path method (CPM) network the total cost of the guarantee period services in accordance with the guarantee period service section(s) of the specifications. This cost shall be priced out when submitting the CMP cost loaded network. The cost submitted shall be subject to the approval of the contracting officer. The activity on the CPM shall have money only and not activity time.

(ii) The contractor shall submit with the CPM a guarantee period performance program which shall include an itemized accounting of the number of work-hours required to perform the guarantee period service on each piece of



**Renovation of the 9<sup>th</sup> Floor of Building 1 - Manhattan, NY**

equipment. The contractor shall also submit the established salary costs, including employee fringe benefits, and what the contractor reasonably expects to pay over the guarantee period, all of which will be subject to the contracting officer's approval.

(iii) The cost of the guarantee period service shall be prorated on an annual basis and paid in equal monthly payments by VA during the period of guarantee. In the event the installer does not perform satisfactorily during this period, all payments may be withheld and the contracting officer shall inform the contractor of the unsatisfactory performance, allowing the contractor 10 days to correct and comply with the contract. The guarantee period service is subject to those provisions as set forth in the Payments and Default clauses.

**VALUE OF ADJUSTING, CORRECTING, AND TESTING SYSTEM**

<b>System</b>	<b>Percent</b>
Pneumatic tube system	10
Incinerators (medical waste and trash)	5
Sewage treatment plant equipment	5
Water treatment plant equipment	5
Washers (dish, cage, glass, etc.)	5
Sterilizing equipment	5
Water distilling equipment	5
Prefab temperature rooms (cold, constant temperature)	5
Entire air-conditioning system (Specified under 600 Sections)	5
Entire boiler plant system (Specified under 700 Sections)	5
General supply conveyors	10
Food service conveyors	10
Pneumatic soiled linen and trash system	10
Elevators and dumbwaiters	10
Materials transport system	10
Engine-generator system	5
Primary switchgear	5

Renovation of the 9<sup>th</sup> Floor of Building 1 - Manhattan, NY

Secondary switchgear	5
Fire alarm system	5
Nurse call system	5
Intercom system	5
Radio system	5
TV (entertainment) system	5

(c) In addition to this cost schedule, the contractor shall submit such unit costs as may be specifically requested. The unit costs shall be those used by the contractor in preparing his/her bid and will not be binding as pertaining to any contract changes.

(d) The contracting officer will consider for monthly progress payments material and/or equipment procured by the contractor and stored on the construction site as space is available, or at a local approved location off the site, under such terms and conditions as such officer approves, including but not limited to the following:

- (1) The material or equipment is in accordance with the contract requirements and/or approved samples and shop drawings.
- (2) Only those materials and/or equipment as are approved by the resident engineer for storage will be included.
- (3) Such materials and/or equipment will be protected against weather, theft and other hazards and will not be subjected to deterioration.
- (5) All of the other terms, provisions, conditions and covenants contained in the contract shall be and remain in full force and effect as therein provided.
- (6) A supplemental agreement will be executed between the Government and the contractor with the consent of the contractor's surety for off-site storage.

(e) The contractor, prior to receiving a progress or final payment under this contract, shall submit to the contracting officer a certification that the contractor has made payment from proceeds of prior payments, or that timely payment will be made from the proceeds of the progress or final payment then due, to subcontractors and suppliers in accordance with the contractual arrangements with them.

(f) The Government reserves the right to withhold payment until samples, shop drawings, engineer's certificates, additional bonds, payrolls, weekly statements of compliance, proof of title, nondiscrimination compliance reports, or any other things required by this contract, have been submitted to the satisfaction of the contracting officer.

(End of Clause)

#### **4.31 VAAR 852.236-85 SUPPLEMENTARY LABOR STANDARDS PROVISIONS (APR 1984)**

(a) The wage determination decision of the Secretary of Labor is set forth in section GR, General Requirements, of this contract. It is the result of a study of wage conditions in the locality and establishes the minimum hourly rates of wages

**Renovation of the 9<sup>th</sup> Floor of Building 1 - Manhattan, NY**

and fringe benefits for the described classes of labor in accordance with applicable law. No increase in the contract price will be allowed or authorized because of payment of wage rates in excess of those listed.

(b) The contractor shall submit the required copies of payrolls to the contracting officer through the resident engineer or engineer officer, when acting in that capacity. Department of Labor Form WH- 347, Payroll, available from the Superintendent of Documents, Government Printing Office, Washington, DC 20402, may be used for this purpose. If, however, the contractor or subcontractor elects to use an individually composed payroll form, it shall contain the same information shown on Form WH-347, and in addition be accompanied by Department of Labor Form WH-348, Statement of Compliance, or any other form containing the exact wording of this form.

(End of Clause)

**4.32 VAAR 852.236-86 WORKER'S COMPENSATION (JAN 2008)**

Public Law 107-217 (40 U.S.C. 3172) authorizes the constituted authority of States to apply their workers compensation laws to all lands and premises owned or held by the United States.

(End of Clause)

**4.33 VAAR 852.236-87 ACCIDENT PREVENTION (SEP 1993)**

The Resident Engineer on all assigned construction projects, or other Department of Veterans Affairs employee if designated in writing by the Contracting Officer, shall serve as Safety Officer and as such has authority, on behalf of the Contracting Officer, to monitor and enforce Contractor compliance with FAR 52.236-13, Accident Prevention. However, only the Contracting Officer may issue an order to stop all or part of the work while requiring satisfactory or corrective action to be taken by the Contractor.

(End of Clause)

**4.34 VAAR 852.236-88 CONTRACT CHANGES--SUPPLEMENT (JUL 2002)**

(a) Paragraphs (a)(1) through (a)(4) apply to proposed contract changes costing over \$500,000.

(1) When requested by the contracting officer, the contractor shall submit proposals for changes in work to the resident engineer. Proposals, to be submitted as expeditiously as possible but within 30 calendar days after receipt of request, shall be in legible form, original and two copies, with an itemized breakdown that will include material, quantities, unit prices, labor costs (separated into trades), construction equipment, etc. (Labor costs are to be identified with specific material placed or operation performed.) The contractor must obtain and furnish with a proposal an itemized breakdown as described above, signed by each subcontractor participating in the change regardless of tier. When certified cost or pricing data are required under FAR Subpart 15.403, the cost or pricing data shall be submitted in accordance with FAR 15.403-5.

(2) When the necessity to proceed with a change does not allow sufficient time to negotiate a modification or because of failure to reach an agreement, the contracting officer may issue a change order instructing the contractor to proceed on the basis of a tentative price based on the best estimate available at the time, with the firm price to be determined later. Furthermore, when the change order is issued, the contractor shall submit a proposal, which includes the information required by paragraph (a)(1), for cost of changes in work within 30 calendar days.

(3) The contracting officer will consider issuing a settlement by determination to the contract if the contractor's proposal required by paragraphs (a)(1) or (a)(2) of this clause is not received within 30 calendar days or if agreement has not been reached.

(4) Bond premium adjustment, consequent upon changes ordered, will be made as elsewhere specified at the time of final settlement under the contract and will not be included in the individual change.

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(b) Paragraphs (b)(1) through (b)(11) apply to proposed contract changes costing \$500,000 or less:

(1) When requested by the contracting officer, the contractor shall submit proposals for changes in work to the resident engineer. Proposals, to be submitted as expeditiously as possible but within 30 calendar days after receipt of request, shall be in legible form, original and two copies, with an itemized breakdown that will include material, quantities, unit prices, labor costs (separated into trades), construction equipment, etc. (Labor costs are to be identified with specific material placed or operation performed.) The contractor must obtain and furnish with a proposal an itemized breakdown as described above, signed by each subcontractor participating in the change regardless of tier. When certified cost or pricing data or information other than cost or pricing data are required under FAR 15.403, the data shall be submitted in accordance with FAR 15.403-5. No itemized breakdown will be required for proposals amounting to less than \$1,000.

(2) When the necessity to proceed with a change does not allow sufficient time to negotiate a modification or because of failure to reach an agreement, the contracting officer may issue a change order instructing the contractor to proceed on the basis of a tentative price based on the best estimate available at the time, with the firm price to be determined later. Furthermore, when the change order is issued, the contractor shall submit within 30 calendar days, a proposal that includes the information required by paragraph (b)(1) for the cost of the changes in work.

(3) The contracting officer will consider issuing a settlement by determination to the contract if the contractor's proposal required by paragraphs (b)(1) or (b)(2) of this clause is not received within 30 calendar days, or if agreement has not been reached.

(4) Allowances not to exceed 10 percent each for overhead and profit for the party performing the work will be based on the value of labor, material, and use of construction equipment required to accomplish the change. As the value of the change increases, a declining scale will be used in negotiating the percentage of overhead and profit. Allowable percentages on changes will not exceed the following: 10 percent overhead and 10 percent profit on the first \$20,000; 7-1/2 percent overhead and 7-1/2 percent profit on the next \$30,000; 5 percent overhead and 5 percent profit on balance over \$50,000. Profit shall be computed by multiplying the profit percentage by the sum of the direct costs and computed overhead costs.

(5) The prime contractor's or upper-tier subcontractor's fee on work performed by lower-tier subcontractors will be based on the net increased cost to the prime contractor or upper-tier subcontractor, as applicable. Allowable fee on changes will not exceed the following: 10 percent fee on the first \$20,000; 7-1/2 percent fee on the next \$30,000; and 5 percent fee on balance over \$50,000.

(6) Not more than four percentages, none of which exceed the percentages shown above, will be allowed regardless of the number of tiers of subcontractors.

(7) Where the contractor's or subcontractor's portion of a change involves credit items, such items must be deducted prior to adding overhead and profit for the party performing the work. The contractor's fee is limited to the net increase to contractor of subcontractors' portions cost computed in accordance herewith.

(8) Where a change involves credit items only, a proper measure of the amount of downward adjustment in the contract price is the reasonable cost to the contractor if he/she had performed the deleted work. A reasonable allowance for overhead and profit are properly includable as part of the downward adjustment for a deductive change. The amount of such allowance is subject to negotiation.

(9) Cost of Federal Old Age Benefit (Social Security) tax and of Worker's Compensation and Public Liability insurance appertaining to changes are allowable. While no percentage will be allowed thereon for overhead or profit, prime contractor's fee will be allowed on such items in subcontractors' proposals.

**Renovation of the 9<sup>th</sup> Floor of Building 1 - Manhattan, NY**

(10) Overhead and contractor's fee percentages shall be considered to include insurance other than mentioned herein, field and office supervisors and assistants, security police, use of small tools, incidental job burdens, and general home office expenses and no separate allowance will be made therefore. Assistants to office supervisors include all clerical, stenographic and general office help. Incidental job burdens include, but are not necessarily limited to, office equipment and supplies, temporary toilets, telephone and conformance to OSHA requirements. Items such as, but not necessarily limited to, review and coordination, estimating and expediting relative to contract changes are associated with field and office supervision and are considered to be included in the contractor's overhead and/or fee percentage.

(11) Bond premium adjustment, consequent upon changes ordered, will be made as elsewhere specified at the time of final settlement under the contract and will not be included in the individual change.

(End of Clause)

**4.35 VAAR 852.236-89 BUY AMERICAN ACT (JAN 2008) ALTERNATE I (JAN 2008)**

(a) Reference is made to the clause entitled "Buy American Act--Construction Materials under Trade Agreements," FAR 52.225-11.

(b) The restrictions contained in this clause 852.236-89 are waived for designated country construction material as defined in FAR 52.225-11. Notwithstanding a bidder's right to offer identifiable foreign construction material in its bid pursuant to FAR 52.225-11, VA does not anticipate accepting an offer that includes foreign construction material, other than designated country construction material.

(c) If a bidder chooses to submit a bid that includes foreign construction material, that bidder must provide a listing of the specific foreign construction material he/she intends to use and a price for said material. Bidders must include bid prices for comparable domestic construction material. If VA determines not to accept foreign construction material and no comparable domestic construction material is provided, the entire bid will be rejected.

(d) Any foreign construction material proposed after award will be rejected unless the bidder proves to VA's satisfaction: (1) it was impossible to request the exemption prior to award, and (2) said domestic construction material is no longer available, or (3) where the price has escalated so dramatically after the contract has been awarded that it would be unconscionable to require performance at that price. The determinations required by (1), (2), and (3) of this paragraph shall be made in accordance with Subpart 825.2 and FAR 25.2.

(e) By signing this bid, the bidder declares that all articles, materials and supplies for use on the project shall be domestic unless specifically set forth on the Bid Form or addendum thereto.

(End of Clause)

**4.36 VAAR 852.236-90 RESTRICTION ON SUBMISSION AND USE OF EQUAL PRODUCTS (NOV 1986)**

This clause applies to the following items:

See Design Specifications

Notwithstanding the "Material and Workmanship" clause of this contract, FAR 52.236-5(a), nor any other contractual provision, "equal" products will not be considered by the Department of Veterans Affairs and may not be used.

(End of Clause)

#### **4.37 VAAR 852.236-91 SPECIAL NOTES (JUL 2002)**

(a) Signing of the bid shall be deemed to be a representation by the bidder that:

(1) Bidder is a construction contractor who owns, operates, or maintains a place of business, regularly engaged in construction, alteration, or repair of buildings, structures, and communications facilities, or other engineering projects, including furnishing and installing of necessary equipment; or

(2) If newly entering into a construction activity, bidder has made all necessary arrangements for personnel, construction equipment, and required licenses to perform construction work; and

(3) Upon request, prior to award, bidder will promptly furnish to the Government a statement of facts in detail as to bidder's previous experience (including recent and current contracts), organization (including company officers), technical qualifications, financial resources and facilities available to perform the contemplated work.

(b) Unless otherwise provided in this contract, where the use of optional materials or construction is permitted, the same standard of workmanship, fabrication and installation shall be required irrespective of which option is selected. The contractor shall make any change or adjustment in connecting work or otherwise necessitated by the use of such optional material or construction, without additional cost to the Government.

(c) When approval is given for a system component having functional or physical characteristics different from those indicated or specified, it is the responsibility of the contractor to furnish and install related components with characteristics and capacities compatible with the approved substitute component as required for systems to function as noted on drawings and specifications. There shall be no additional cost to the Government.

(d) In some instances it may have been impracticable to detail all items in specifications or on drawings because of variances in manufacturers' methods of achieving specified results. In such instances the contractor will be required to furnish all labor, materials, drawings, services and connections necessary to produce systems or equipment which are completely installed, functional, and ready for operation by facility personnel in accordance with their intended use.

(e) Claims by the contractor for delay attributed to unusually severe weather must be supported by climatological data covering the period and the same period for the 10 preceding years. When the weather in question exceeds in intensity or frequency the 10-year average, the excess experienced shall be considered "unusually severe." Comparison shall be on a monthly basis. Whether or not unusually severe weather in fact delays the work will depend upon the effect of weather on the branches of work being performed during the time under consideration.

(End of Clause)

#### **4.38 VAAR 852.246-74 SPECIAL WARRANTIES (JAN 2008)**

The clause entitled "Warranty of Construction" in FAR 52.246-21 is supplemented as follows:

Any special warranties that may be required under the contract shall be subject to the elections set forth in the FAR clause at 52.246-21, Warranty of Construction, unless otherwise provided for in such special warranties.

(End of Clause)

#### **4.39 VAAR 852.246-75 WARRANTY FOR CONSTRUCTION--GUARANTEE PERIOD SERVICES (JAN 2008)**

The clause entitled "Warranty of Construction" in FAR 52.246-21 is supplemented as follows:

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Should the contractor fail to prosecute the work or fail to proceed promptly to provide guarantee period services after notification by the contracting officer, the Government may, subject to the default clause contained at FAR 52.249-10, Default (Fixed- Price Construction), and after allowing the contractor 10 days to correct and comply with the contract, terminate the right to proceed with the work (or the separable part of the work) that has been delayed or unsatisfactorily performed. In this event, the Government may take over the work and complete it by contract or otherwise, and may take possession of and use any materials, appliances, and plant on the work site necessary for completing the work. The contractor and its sureties shall be liable for any damages to the Government resulting from the contractor's refusal or failure to complete the work within this specified time, whether or not the contractor's right to proceed with the work is terminated. This liability includes any increased costs incurred by the Government in completing the work.

(End of Clause)

**4.40 MANDATORY WRITTEN DISCLOSURES**

Mandatory written disclosures required by FAR clause 52.203-13 to the Department of Veterans Affairs, Office of Inspector General (OIG) must be made electronically through the VA OIG Hotline at <http://www.va.gov/oig/contacts/hotline.asp> and clicking on "FAR clause 52.203-13 Reporting." If you experience difficulty accessing the website, call the Hotline at 1-800-488-8244 for further instructions.

(End of Clause)

General Decision Number: NY130003 08/09/2013 NY3

Superseded General Decision Number: NY20120003

State: New York

Construction Types: Building, Heavy, Highway and Residential

Counties: Bronx, Kings, New York, Queens and Richmond  
Counties in New York.

BUILDING & RESIDENTIAL CONSTRUCTION PROJECTS (includes single family homes and apartments up to and including 4 stories),  
HEAVY AND HIGHWAY CONSTRUCTION PROJECTS

Modification Number	Publication Date
0	01/04/2013
1	01/11/2013
2	01/18/2013
3	02/08/2013
4	03/22/2013
5	04/26/2013
6	05/03/2013
7	05/17/2013
8	05/31/2013
9	06/07/2013
10	07/05/2013
11	07/26/2013
12	08/02/2013
13	08/09/2013

ASBE0012-001 07/01/2013

Renovation of the 9<sup>th</sup> Floor of Building 1 - Manhattan, NY

	Rates	Fringes
Asbestos Workers/Insulator		
Includes application of		
all insulating materials,		
protective coverings,		
coatings and finishes to		
all types of mechanical		
systems.....	\$ 64.13	29.04
HAZARDOUS MATERIAL HANDLER.....	\$ 30.00	9.10

BOIL0005-001 01/01/2013

	Rates	Fringes
BOILERMAKER.....	\$ 49.47	33%+22.87+a

## FOOTNOTE:

a. PAID HOLIDAYS: New Year's Day, Thanksgiving Day, Memorial Day, Independence Day, Labor Day and Good Friday, Friday after Thanksgiving, Christmas Eve Day and New Year's Eve

\* BRNY0001-001 07/01/2013

	Rates	Fringes
BRICKLAYER.....	\$ 49.09	22.93
MASON - STONE.....	\$ 55.56	26.75

BRNY0001-002 07/01/2012

	Rates	Fringes
Pointer, cleaner and caulker.....	\$ 42.69	21.74

BRNY0004-001 07/01/2012

	Rates	Fringes
MARBLE MASON.....	\$ 54.19	28.3

BRNY0007-001 01/01/2011

	Rates	Fringes
TERRAZZO FINISHER.....	\$ 42.86	28.55
TERRAZZO WORKER/SETTER.....	\$ 44.39	28.55

BRNY0020-001 07/01/2012

	Rates	Fringes
MARBLE FINISHER.....	\$ 43.60	27.10

BRNY0024-001 07/01/2012

Rates	Fringes
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Renovation of the 9<sup>th</sup> Floor of Building 1 - Manhattan, NY

## BRICKLAYER

MARBLE POLISHERS.....	\$ 38.03	20.90
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BRNY0052-001 06/04/2012

Rates	Fringes
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Tile Layer.....	\$ 50.25	27.66
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BRNY0088-001 06/04/2012

Rates	Fringes
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TILE FINISHER.....	\$ 39.67	24.16
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CARP0001-009 07/01/2008

Rates	Fringes
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## Carpenters:

Carpenters & Soft floor layers.....	\$ 43.02	35.96
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CARP0740-001 07/01/2010

Rates	Fringes
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MILLWRIGHT.....	\$ 46.19	44.93
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CARP1456-004 01/01/2011

Rates	Fringes
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## Dock Builder &amp; Piledrivermen

DOCKBUILDERS.....	\$ 46.21	38.36
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CARP1456-005 01/01/2011

Rates	Fringes
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Diver Tender.....	\$ 41.16	38.46
Diver.....	\$ 58.01	38.46

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CARP1536-001 10/01/2010

Rates	Fringes
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## Carpenters:

TIMBERMEN.....	\$ 42.63	31.32
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ELEC0003-001 11/09/2011

Rates	Fringes
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## ELECTRICIAN

Electricians.....	\$ 51.00	23.672
Jobbing, and maintenance and repair work.....	\$ 25.30	15.13+a

## PAID HOLIDAYS:

Renovation of the 9<sup>th</sup> Floor of Building 1 - Manhattan, NY

a. New Years Day, Martin Luther King, Jr.'s Birthday, Washington's Birthday, Memorial Day, Independence Day, Labor Day, Columbus Day, Election Day, Thanksgiving Day, the day after Thanksgiving Day, and Christmas Day

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ELEC1049-001 03/31/2013

## QUEENS COUNTY

	Rates	Fringes
Line Construction (Substation and Switching structures pipe type cable installation and maintenance jobs or projects; Railroad electrical distribution/transmission systems maintenance (when work is not performed by railroad employees) Overhead and Underground transmission/distribution line work. Fiber optic, telephone cable and equipment)		
Groundman.....	\$ 28.99	17.83
Heavy Equipment Operator....	\$ 38.65	18.14
Lineman and Cable Splicer...	\$ 48.31	23.07
Tree Trimmer.....	\$ 23.06	28.5%+9.75

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ELEV0001-002 03/17/2013

	Rates	Fringes
ELEVATOR MECHANIC		
Elevator Constructor.....	\$ 57.01	27.605+a+b
Modernization and Repair....	\$ 45.14	27.455+a+b

## FOOTNOTE:

a. PAID HOLIDAYS: New Year's Day, Good Friday, President's Day, Memorial Day, Independence Day, Labor Day, Columbus Day, Veteran's Day, Thanksgiving Day, Friday after Thanksgiving, and Christmas Day.

b. PAID VACATION: An employee who has worked less than 5 years shall receive vacation pay credit on the basis of 4% of his hourly rate for all hours worked; an employee who has worked 5 to 15 years shall receive vacation pay credit on the basis of 6% of his hourly rate for all hours worked; an employee who has worked 15 or more years shall receive vacation pay credit on the basis of 8% of his hourly rate for all hours worked.

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ENGI0014-001 07/01/2012

Rates	Fringes
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Renovation of the 9<sup>th</sup> Floor of Building 1 - Manhattan, NY

## Pavement equipment operator

Asphalt Plants.....	\$ 51.32	25.88+a
Asphalt roller.....	\$ 60.85	25.88+a
Asphalt spreader.....	\$ 62.51	25.88+a

## Power Equipment Operator

## (HEAVY &amp; HIGHWAY)

GROUP 1.....	\$ 81.09	25.88
GROUP 10.....	\$ 58.43	25.88
GROUP 11.....	\$ 54.50	25.88
GROUP 12.....	\$ 55.73	25.88
GROUP 13.....	\$ 56.19	25.88
GROUP 14.....	\$ 42.11	25.88
GROUP 15.....	\$ 39.03	25.88
GROUP 2.....	\$ 66.70	25.88
GROUP 3.....	\$ 68.86	25.88
GROUP 4.....	\$ 67.21	25.88
GROUP 5.....	\$ 65.86	25.88
GROUP 6.....	\$ 63.18	25.88
GROUP 7.....	\$ 64.38	25.88
GROUP 8.....	\$ 62.51	25.88
GROUP 9.....	\$ 61.14	25.88

## Steel erector

## Compressors, Welding

Machines.....	\$ 39.86	24.15
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## Cranes, Hydraulic Cranes,

## 2 drum derricks,

Forklifts, Boom Trucks.....	\$ 67.71	24.15
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Three drum derricks.....	\$ 70.50	24.15
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## Utility Laborer

Horizontal Boring Rig.....	\$ 56.24	24.15
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Off shift compressors.....	\$ 46.38	24.15
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Utility Compressors.....	\$ 36.37	24.15
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## POWER EQUIPMENT OPERATOR CLASSIFICATIONS

## GROUP 1: Tower crane

GROUP 2: Backhoes, power shovel, Hydraulic clam shells, moles and machines of a similar type

## GROUP 3: Mine hoists and crane, etc. used as mine hoists

GROUP 4: Gradalls, keystones, cranes (with digging buckets), bridge cranes, trenching machines, vermeer cutter and machines of a similar nature

## GROUP 5: Piledrivers, derrick boats, tunnel shovels

## GROUP 6: All drills, and machines of a similar nature

GROUP 7: Back filling machines, cranes, mucking machines, dual drum pavers

GROUP 8: Mixers (concrete w/loading attachments), concrete pavers, cableways, land derricks, power house (low pressure units), concrete pumps

GROUP 9: Concrete plants, well drilling machines, stone crushers double drum hoist, power house (other than above)

**Renovation of the 9<sup>th</sup> Floor of Building 1 - Manhattan, NY**

GROUP 10: Concrete mixers

GROUP 11: Elevators

GROUP 12: Concrete breaking machine, Hoists (single drum),  
load masters, locomotive and dinkies over 10 tons

GROUP 13: Vibratory console

GROUP 14: Compressors (portable 3 or more in battery), tugger  
machine (caissons), well point pumps, chum drillGROUP 15: Boilers, (high pressure, compressors (portable,  
single, or 2 in battery, not over 100' apart), pumps (river  
cofferdam and welding machines (except where arc is  
operated by members of local 15) push button machines, all  
engines irrespective of power (power pac) used to drive  
auxilliary equipment, air, hydraulic etc.

## PREMIUMS ON CRANES (Crawler or Truck):

100' to 149' boom - add .50  
150' to 249' boom - add .75  
250' to 349' boom - add 1.00  
350' to 450' boom - add 1.50

## Premiums for Cranes on Steel Erection:

100' to 149' boom - add 1.75  
150' to 249' boom - add 2.00  
250' to 349' boom - add 2.25  
350' to 450' boom - add 2.75  
Tower crane - add 2.00

## FOOTNOTE:

a. Paid Holidays: New Year's Day; Lincoln's Birthday;  
Washington's Birthday; Memorial Day; Independence Day;  
Labor Day; Veterans Day; Columbus Day; Election Day;  
Thanksgiving Day; and Christmas Day; provided the employee  
works one day the payroll week in which the holiday occurs.-----  
ENGI0014-002 07/01/2012

	Rates	Fringes
Power Equipment Operator		
BUILDING & RESIDENTIAL		
GROUP 1.....	\$ 58.57	24.15
GROUP 2.....	\$ 62.15	24.15
GROUP 3.....	\$ 61.06	24.15
GROUP 4.....	\$ 55.46	24.15
GROUP 5.....	\$ 41.32	24.15

## POWER EQUIPMENT OPERATORS CLASSIFICATIONS

GROUP 1: Double drum

GROUP 2: Stone derrick, cranes, hydraulic cranes, boom  
trucks

GROUP 3: 4 pole Hoist, Single Drum Hoists

**Renovation of the 9<sup>th</sup> Floor of Building 1 - Manhattan, NY**

GROUP 4: Fork lift, house cars, plaster (platform machine), plaster bucket, concrete pump and all other equipment used for hoisting material

GROUP 5: Compressors, welding machines (cutting concrete work), paint spraying, sand blasting, pumps (with the exclusion of concrete pumps), house car (settlement basis only), all engines irrespective of power (power pac) used to drive auxiliary equipment, air, hydraulic, etc., boilers

## Premiums for Cranes:

100'-149' boom - add 1.75  
 150'-249' boom - add 2.00  
 250'-349' boom - add 2.25  
 350'-450' boom - add 2.75  
 Tower cranes add 2.00

## FOOTNOTE:

a. PAID HOLIDAYS: New Year's Day, Lincoln's Birthday, Memorial Day, Independence Day, Labor Day, Veteran's Day, Columbus Day, Election Day, Thanksgiving Day, and Christmas Day, provided the employee works one day in the payroll week in which the holiday occurs

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 IRON0040-002 07/01/2013

BRONX, NEW YORK, RICHMOND

	Rates	Fringes
IRONWORKER, STRUCTURAL.....	\$ 46.75	50.98

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IRON0046-003 07/01/2011

	Rates	Fringes
IRONWORKER METALLIC LATHERS AND REINFORCING IRONWORKERS.....	\$ 40.00	24.97

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IRON0197-001 01/01/2013

	Rates	Fringes
IRONWORKER STONE DERRICKMAN.....	\$ 41.00	36.57

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IRON0361-002 07/01/2013

KINGS, QUEENS

	Rates	Fringes
Ironworkers: (STRUCTURAL).....	\$ 46.75	50.98

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IRON0580-001 07/01/2012

Renovation of the 9<sup>th</sup> Floor of Building 1 - Manhattan, NY

	Rates	Fringes
IRONWORKER, ORNAMENTAL.....	\$ 41.50	40.62

-----  
LABO0006-001 07/01/2011

	Rates	Fringes
Laborers:		
BUILDING CONSTRUCTION		
CEMENT AND CONCRETE		
WORKERS.....	\$ 38.98	26.08

-----  
LABO0029-001 07/01/2012

	Rates	Fringes
Laborers:		
Heavy		
Blasters (hydraulic trac		
drill).....	\$ 41.30	29.25
Blasters.....	\$ 40.55	29.25
Hydraulic Trac Drill.....	\$ 29.92	29.25
Jackhammers, Chippers,		
Spaders, Concrete		
Breakers, All Other		
Pneumatic Tools, Walk		
Behind Self-Propelled		
Hydraulic Asphalt and		
Concrete Breaker.....	\$ 34.64	29.25
Powder Carriers.....	\$ 31.08	29.25
Wagon; Airtrac; Quarry		
Bar Drill Runners.....	\$ 35.07	28.00

-----  
LABO0078-001 02/01/2013

	Rates	Fringes
LABORERS		
BUILDING CONSTRUCTION		
ASBESTOS (Removal,		
Abatement, Encapsulation		
or Decontamination of		
asbestos); LEAD; &		
HAZARDOUS WASTE LABORERS		
(Hazardous Waste,		
Hazardous Materials,		
Biochemical and Mold		
Remediation, HVAC, Duct		
Cleaning, Re-spray		
Fireproofing, etc).....	\$ 35.90	14.75

-----  
LABO0079-001 07/01/2013

	Rates	Fringes
Laborers Building Construction		
Demolition Laborers		
Tier A.....	\$ 35.34	18.9
Tier B.....	\$ 24.53	13.37

**Renovation of the 9<sup>th</sup> Floor of Building 1 - Manhattan, NY**

Mason Tenders.....\$ 37.00 23.35

## CLASSIFICATIONS

TIER A: Responsible for the removal of all interior petitions and structural petitions that can consist of sheet rock, block or masonry. Also, all structural slab openings for ducts, mechanical, shafts, elevators, slab openings and exterior walls where the building is not being completely demolished.

TIER B: Responsible for shoveling of debris into containers, pushing containers from the inside to the outside of the building.

-----  
LABO0147-001 07/01/2012

	Rates	Fringes
LABORERS (FREE AIR & TUNNEL).....	\$ 58.30	27.20

Maintenance Men, Inside Muck Lock Tenders, Pump Men, Electricians, Cement Finishers, Caulkers, Hydraulic Men, Shield Men, Monorail Operators, Motor Men, Conveyor Men, Powder Carriers, Pan Men, Riggers, Chuck Tenders, Track Men Painters, Nippers, Brakemen, Cable Men, Hose Men, Grout Men, Gravel Men, Form Workers, Concrete Workers, Tunnel Laborers, Mole Nipper (one (1) Mole Sipper per Working Shaft per Shift for up to and including Two (2) Moles

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LABO0731-001 07/01/2011

	Rates	Fringes
Laborers:		
Building, Heavy and Residential Construction		
UNSKILLED.....	\$ 38.20	30.27
UTILITY LABORER.....	\$ 38.05	30.27
Heavy & Highway Construction		
LABORER/EXCAVATION {Asbestos, Lead, Hazardous Waste Removal (including soil).....	\$ 36.64	26.21

Paid Holidays: Labor Day and Thanksgiving Day

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\* LABO1010-001 07/01/2011

	Rates	Fringes
Laborers:		
HIGHWAY CONSTRUCTION		
Fence Installer & Repairer..	\$ 38.34	30.25
FORMSETTERS.....	\$ 42.21	30.25
LABORERS.....	\$ 38.34	30.25
Landscape Planting &		

**Renovation of the 9<sup>th</sup> Floor of Building 1 - Manhattan, NY**

Maintenance.....	\$ 38.34	30.25
Maintenance Safety Surface..	\$ 38.34	30.25
Slurry/Sealcoater/Play		
Equipment Installer.....	\$ 38.34	30.25
Small Equipment Operator		
(Not Operating Engineer)...	\$ 38.34	30.25
Small Power Tools Operator..	\$ 38.34	30.25

## FOOTNOTES:

a. PAID HOLIDAYS: Memorial Day, Fourth of July, Labor Day, Columbus Day, Election Day and Thanksgiving Day, provided the employee has worked one (1) day in the calendar week in which the said holiday occurs.

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LAB01010-002 07/01/2011

	Rates	Fringes
Laborers-Asphalt Construction:		
Micro Paver.....	\$ 44.86	30.25
Raker.....	\$ 44.37	30.25
Screedperson.....	\$ 44.86	30.25
Shoveler (Production		
Paving Only).....	\$ 41.08	30.25
Small Equipment Operator		
(Asphalt).....	\$ 41.08	30.25

-----  
PAIN0009-001 05/01/2013

	Rates	Fringes
GLAZIER.....	\$ 42.00	33.14
Painters:		
Painters, Drywall		
Finishers, Lead Abatement		
Worker.....	\$ 41.75	20.87
Spray, Scaffold and		
Sandblasting.....	\$ 44.75	20.87

-----  
PAIN0806-001 10/01/2012

	Rates	Fringes
Painters:		
Structural Steel and Bridge..	\$ 47.00	32.08

-----  
PAIN1974-001 12/26/2012

	Rates	Fringes
Painters:		
Drywall Tapers/Pointers.....	\$ 43.82	22.01

-----  
PLAS0262-001 02/01/2012

	Rates	Fringes
PLASTERER.....	\$ 40.78	26.80



Renovation of the 9<sup>th</sup> Floor of Building 1 - Manhattan, NY-----  
PLAS0262-002 02/01/2012

KINGS AND QUEENS COUNTIES

	Rates	Fringes
PLASTERER.....	\$ 40.78	26.80

-----  
PLAS0780-001 07/01/2013

	Rates	Fringes
CEMENT MASON/CONCRETE FINISHER...	\$ 44.63	38.95

-----  
PLUM0001-001 01/01/2013

	Rates	Fringes
PLUMBER		
MECHANICAL EQUIPMENT AND SERVICE		
Any repair and/or replacement of the present plumbing system that does not change the existing roughing.....	\$ 33.21	16.05
PLUMBERS:.....	\$ 52.86	36.21

-----  
PLUM0638-001 06/27/2012

	Rates	Fringes
PLUMBER		
SERVICE FITTERS.....	\$ 26.30	2.55
SPRINKLER FITTERS, STEAMFITTERS.....	\$ 51.25	49.54

Service Fitter work shall consist of all repair, service and maintenance work on domestic, commercial and industrial refrigeration, air conditioning and air cooling, stoker and oil burner apparatus and heating apparatus etc., including but not exclusively the charging, evacuation, leak testing and assembling for all machines for domestic, commercial and industrial refrigeration, air conditioning and heating apparatus. Also, work shall include adjusting, including capacity adjustments, checking and repairing or replacement of all controls and start up of all machines and repairing all defects that may develop on any system for domestic, commercial and industrial refrigeration and all air conditioning, air cooling, stoker and oil burner apparatus and heating apparatus regardless of size or type.

-----  
ROOF0008-003 07/01/2012

	Rates	Fringes
ROOFER.....	\$ 39.00	27.35

SHEE0028-002 09/15/2011

	Rates	Fringes
SHEET METAL WORKER		
BUILDING CONSTRUCTION.....	\$ 48.90	36.00
RESIDENTIAL CONSTRUCTION....	\$ 27.22	16.48

-----  
TEAM0282-001 07/01/2012

	Rates	Fringes
Truck drivers:		
TRUCK DRIVERS:		
Asphalt.....	\$ 37.47	38.5525+a
Euclids & Turnapulls.....	\$ 37.57	38.5525+a
High Rise.....	\$ 42.00	36.9125+a

FOOTNOTES:

PAID HOLIDAYS: New Year's Day, Presidents' Day, Memorial Day, Independence Day, Labor Day, Columbus Day, Election Day, Veterans' Day (Armistice Day), Thanksgiving Day, Day after Thanksgiving and Christmas Day. Employees working two (2) days in the calendar week in which a holiday falls are to be paid for such holiday, provided that they shape each remaining workday during such calendar week.

-----  
WELDERS - Receive rate prescribed for craft performing operation to which welding is incidental.

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Unlisted classifications needed for work not included within the scope of the classifications listed may be added after award only as provided in the labor standards contract clauses (29CFR 5.5 (a) (1) (ii)).

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The body of each wage determination lists the classification and wage rates that have been found to be prevailing for the cited type(s) of construction in the area covered by the wage determination. The classifications are listed in alphabetical order of "identifiers" that indicate whether the particular rate is union or non-union.

Union Identifiers

An identifier enclosed in dotted lines beginning with characters other than "SU" denotes that the union classification and rate have found to be prevailing for that classification. Example: PLUM0198-005 07/01/2011. The first four letters , PLUM, indicate the international union and the

**Renovation of the 9<sup>th</sup> Floor of Building 1 - Manhattan, NY**

four-digit number, 0198, that follows indicates the local union number or district council number where applicable , i.e., Plumbers Local 0198. The next number, 005 in the example, is an internal number used in processing the wage determination. The date, 07/01/2011, following these characters is the effective date of the most current negotiated rate/collective bargaining agreement which would be July 1, 2011 in the above example.

Union prevailing wage rates will be updated to reflect any changes in the collective bargaining agreements governing the rates.

0000/9999: weighted union wage rates will be published annually each January.

**Non-Union Identifiers**

Classifications listed under an "SU" identifier were derived from survey data by computing average rates and are not union rates; however, the data used in computing these rates may include both union and non-union data. Example: SULA2004-007 5/13/2010. SU indicates the rates are not union majority rates, LA indicates the State of Louisiana; 2004 is the year of the survey; and 007 is an internal number used in producing the wage determination. A 1993 or later date, 5/13/2010, indicates the classifications and rates under that identifier were issued as a General Wage Determination on that date.

Survey wage rates will remain in effect and will not change until a new survey is conducted.

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**WAGE DETERMINATION APPEALS PROCESS**

1.) Has there been an initial decision in the matter? This can be:

- \* an existing published wage determination
- \* a survey underlying a wage determination
- \* a Wage and Hour Division letter setting forth a position on a wage determination matter
- \* a conformance (additional classification and rate) ruling

On survey related matters, initial contact, including requests for summaries of surveys, should be with the Wage and Hour Regional Office for the area in which the survey was conducted because those Regional Offices have responsibility for the Davis-Bacon survey program. If the response from this initial contact is not satisfactory, then the process described in 2.) and 3.) should be followed.

With regard to any other matter not yet ripe for the formal process described here, initial contact should be with the Branch of Construction Wage Determinations. Write to:

**Renovation of the 9<sup>th</sup> Floor of Building 1 - Manhattan, NY**

Branch of Construction Wage Determinations  
Wage and Hour Division  
U.S. Department of Labor  
200 Constitution Avenue, N.W.  
Washington, DC 20210

2.) If the answer to the question in 1.) is yes, then an interested party (those affected by the action) can request review and reconsideration from the Wage and Hour Administrator (See 29 CFR Part 1.8 and 29 CFR Part 7). Write to:

Wage and Hour Administrator  
U.S. Department of Labor  
200 Constitution Avenue, N.W.  
Washington, DC 20210

The request should be accompanied by a full statement of the interested party's position and by any information (wage payment data, project description, area practice material, etc.) that the requestor considers relevant to the issue.

3.) If the decision of the Administrator is not favorable, an interested party may appeal directly to the Administrative Review Board (formerly the Wage Appeals Board). Write to:

Administrative Review Board  
U.S. Department of Labor  
200 Constitution Avenue, N.W.  
Washington, DC 20210

4.) All decisions by the Administrative Review Board are final.

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END OF GENERAL DECISION

SECTION 01 00 00  
GENERAL REQUIREMENTS

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SECTION 01 00 00  
GENERAL REQUIREMENTS

**1.1 GENERAL INTENTION**

- A. Contractor shall furnish all plant, labor and materials to renovate the 9<sup>th</sup> floor of Building 1 at the Manhattan VAMC including associated demolition and asbestos removal on adjacent floors as required by the contract drawings and specifications.
- B. Visits to the site by Bidders may be made only by appointment with the Medical Center Engineering Officer.
- C. Offices of Cannon Design, as Architect-Engineers, will render certain technical services during construction. Such services shall be considered as advisory to the Government and shall not be construed as expressing or implying a contractual act of the Government without affirmations by Contracting Officer or his duly authorized representative.
- D. Before placement and installation of work subject to tests by testing laboratory retained by the Contractor, the Contractor shall notify the Resident Engineer in sufficient time to enable VA representatives to be present at the site in time for proper taking and testing of specimens and field inspection. Such prior notice shall be not less than three work days unless otherwise designated by the Resident Engineer.
- E. All employees of general contractor and subcontractors shall comply with VA security management program and obtain permission of the VA police, be identified by project and employer, and restricted from unauthorized access.
- F. Prior to commencing work, general contractor shall provide proof that a OSHA designated "competent person" (CP) (29 CFR 1926.20(b)(2)) will maintain a presence at the work site whenever the general or subcontractors are present.
- G. Training:
  - 1. All employees of general contractor or subcontractors shall have the 30-hour OSHA Construction Safety course and other relevant competency training, as determined by RE/COR acting as the Construction Safety Officer with input from the facility Construction Safety Committee.

2. Submit training records of all such employees for approval before the start of work.

H. Compliance with VHA Directive 2011-36, Safety and Health during Construction, dated 9/22/2011 in its entirety is required. The directive will be made available to the Contractor upon request.

## **1.2 STATEMENT OF BID ITEM(S)**

### **A. BASE BID:**

NEW WORK: Work includes renovation of the 9<sup>th</sup> floor of Building 1 to facilitate Outpatient Services in accordance with VA Standards and all applicable state and federal regulations.

ASBESTOS ABATEMENT: Work includes removal and disposal of hazardous materials on the 8<sup>th</sup> floor of Building 1 in accordance with all applicable state and federal regulations, as necessary for removal of existing utilities and for construction on the 9<sup>th</sup> floor.

SELECTIVE DEMOLITION: Work includes removal and disposal of building materials and equipment on the 9<sup>th</sup> floor of Building 1 in accordance with the specifications and contract drawings.

## **1.3 SPECIFICATIONS AND DRAWINGS FOR CONTRACTOR**

A. AFTER AWARD OF CONTRACT, electronic copies of specifications and drawings will be furnished in .pdf format.

## **1.4 CONSTRUCTION SECURITY REQUIREMENTS**

### **A. Security Plan:**

1. The security plan defines both physical and administrative security procedures that will remain effective for the entire duration of the project.
2. The General Contractor is responsible for assuring that all sub-contractors working on the project and their employees also comply with these regulations.

### **B. Security Procedures:**

1. General Contractor's employees shall not enter the project site without appropriate badge. They may also be subject to inspection of their personal effects when entering or leaving the project site.
2. For working outside the "regular hours" as defined in the contract, The General Contractor shall give 3 days notice to the Contracting Officer so that arrangements can be provided for the employees.



This notice is separate from any notices required for utility shutdown described later in this section.

3. No photography of VA premises is allowed without written permission of the Contracting Officer.
4. VA reserves the right to close down or shut down the project site and order General Contractor's employees off the premises in the event of a national emergency. The General Contractor may return to the site only with the written approval of the Contracting Officer.
5. The Contractor shall provide a 24 hour fire watch of the construction area until fire alarm system has been accepted.

C. Guards: N/A

D. Key Control:

1. The General Contractor shall provide duplicate keys and lock combinations to the Resident Engineer for the purpose of security inspections of every area of project including tool boxes and parked machines and take any emergency action.

E. Document Control:

1. Before starting any work, the General Contractor/Sub Contractors shall submit an electronic security memorandum describing the approach to following goals and maintaining confidentiality of "sensitive information".
2. The General Contractor is responsible for safekeeping of all drawings, project manual and other project information. This information shall be shared only with those with a specific need to accomplish the project.
4. Certain documents, sketches, videos or photographs and drawings may be marked "Law Enforcement Sensitive" or "Sensitive Unclassified". Secure such information in separate containers and limit the access to only those who will need it for the project. Return the information to the Contracting Officer upon request.
5. These security documents shall not be removed or transmitted from the project site without the written approval of Contracting Officer.
6. All paper waste or electronic media such as CD's and diskettes shall be shredded and destroyed in a manner acceptable to the VA.
7. Notify Contracting Officer and Site Security Officer immediately when there is a loss or compromise of "sensitive information".

8. All electronic information shall be stored in specified location following VA standards and procedures using an Engineering Document Management Software (EDMS).
  - a. Security, access and maintenance of all project drawings, both scanned and electronic shall be performed and tracked through the EDMS system.
  - b. "Sensitive information" including drawings and other documents may be attached to e-mail provided all VA encryption procedures are followed.

F. Motor Vehicle Restrictions

1. Vehicle authorization request shall be required for any vehicle entering the site and such request shall be submitted 24 hours before the date and time of access. Access shall be restricted to picking up and dropping off materials and supplies.
2. Parking is NOT available on site for the General Contractor, his employees or his subs.

**1.5 FIRE SAFETY**

- A. Applicable Publications: Publications listed below form part of this Article to extent referenced. Publications are referenced in text by basic designations only.
1. American Society for Testing and Materials (ASTM):
    - E84-2009 .....Surface Burning Characteristics of Building Materials
  2. National Fire Protection Association (NFPA):
    - 10-2010 .....Standard for Portable Fire Extinguishers
    - 30-2008 .....Flammable and Combustible Liquids Code
    - 51B-2009 .....Standard for Fire Prevention During Welding, Cutting and Other Hot Work
    - 70-2011 .....National Electrical Code
    - 241-2009 .....Standard for Safeguarding Construction, Alteration, and Demolition Operations
  3. Occupational Safety and Health Administration (OSHA):
    - 29 CFR 1926 .....Safety and Health Regulations for Construction
- B. Fire Safety Plan: Establish and maintain a fire protection program in accordance with 29 CFR 1926. Prior to start of work, prepare a plan detailing project-specific fire safety measures, including periodic status reports, and submit to Resident Engineer for review for

compliance with contract requirements in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA AND SAMPLES. Prior to any worker for the contractor or subcontractors beginning work, they shall undergo a safety briefing provided by the general contractor's competent person per OSHA requirements. This briefing shall include information on the construction limits, VAMC safety guidelines, means of egress, break areas, work hours, locations of restrooms, use of VAMC equipment, etc. Documentation shall be provided to the Resident Engineer that individuals have undergone contractor's safety briefing. Contractor shall install and maintain temporary lighting and exit signs.

- C. Site and Building Access: Maintain free and unobstructed access to facility emergency services and for fire, police and other emergency response forces in accordance with NFPA 241. The Contractor shall provide a 24 hour fire watch of the construction area until fire alarm system has been accepted.
- D. Separate temporary facilities, such as trailers, storage sheds, and dumpsters, from existing buildings and new construction by distances in accordance with NFPA 241. For small facilities with less than 6 m (20 feet) exposing overall length, separate by 3m (10 feet).
- E. Temporary Construction Partitions:
  - 1. Install and maintain temporary construction partitions to provide smoke-tight separations between construction areas adjoining areas. Construct partitions of gypsum board or treated plywood (flame spread rating of 25 or less in accordance with ASTM E84) on both sides of fire retardant treated wood or metal steel studs. Extend the partitions through suspended ceilings to floor slab deck or roof. Seal joints and penetrations. At door openings, install Class C, ¾ hour fire/smoke-rated doors with self-closing devices.
  - 2. Install fire-rated temporary construction partitions as shown on drawings to maintain integrity of existing exit stair enclosures, exit passageways, fire-rated enclosures of hazardous areas, horizontal exits, smoke barriers, vertical shafts and openings enclosures.
  - 3. Close openings in smoke barriers and fire-rated construction to maintain fire ratings. Seal penetrations with listed through-penetration firestop materials in accordance with Section 07 84 00, FIRESTOPPING.

- F. Temporary Heating and Electrical: Install, use and maintain installations in accordance with 29 CFR 1926, NFPA 241 and NFPA 70.
- G. Means of Egress: Do not block exiting for occupied buildings, including paths from exits to roads. Minimize disruptions and coordinate with Resident Engineer.
- H. Egress Routes for Construction Workers: Maintain free and unobstructed egress. Inspect daily. Report findings and corrective actions weekly to Resident Engineer. Contractor shall install and maintain temporary lighting and exit signs.
- I. Fire Extinguishers: Provide and maintain extinguishers in construction areas and temporary storage areas in accordance with 29 CFR 1926, NFPA 241 and NFPA 10.
- J. Flammable and Combustible Liquids: Store, dispense and use liquids in accordance with 29 CFR 1926, NFPA 241 and NFPA 30.
- K. Standpipes: Install and extend standpipes up with each floor in accordance with 29 CFR 1926 and NFPA 241. Do not charge wet standpipes subject to freezing until weather protected.
- L. Sprinklers: Install, test and activate new automatic sprinklers prior to removing existing sprinklers.
- M. Existing Fire Protection: Do not impair automatic sprinklers, smoke and heat detection, and fire alarm systems, except for portions immediately under construction, and temporarily for connections. Provide fire watch for impairments more than 4 hours in a 24-hour period. Request interruptions in accordance with Article, OPERATIONS AND STORAGE AREAS, and coordinate with Resident Engineer. All existing or temporary fire protection systems (fire alarms, sprinklers) located in construction areas shall be tested as coordinated with the medical center. Parameters for the testing and results of any tests performed shall be recorded by the medical center and copies provided to the Resident Engineer.
- N. Smoke Detectors: Prevent accidental operation. Remove temporary covers at end of work operations each day. Coordinate with Resident Engineer.
- O. Hot Work: Comply with NYHHCS Policy No. 138-11 for Hot Works Operation and Permit requirements. Coordinate with Resident Engineer.
- P. Fire Hazard Prevention and Safety Inspections: Inspect entire construction areas weekly. Coordinate with, and report findings and corrective actions weekly to Resident Engineer.

- Q. Smoking: Smoking is prohibited in and adjacent to construction areas inside existing buildings and additions under construction. In separate and detached buildings under construction, smoking is prohibited except in designated smoking rest areas.
- R. Dispose of waste and debris in accordance with NFPA 241. Remove from buildings daily.
- S. Perform other construction, alteration and demolition operations in accordance with 29 CFR 1926.

#### **1.6 OPERATIONS AND STORAGE AREAS**

- A. The Contractor shall confine all operations (including storage of materials) on Government premises to areas authorized or approved by the Contracting Officer. The Contractor shall hold and save the Government, its officers and agents, free and harmless from liability of any nature occasioned by the Contractor's performance.
- B. Temporary buildings (e.g., storage sheds, shops, offices) and utilities may be erected by the Contractor only with the approval of the Contracting Officer and shall be built with labor and materials furnished by the Contractor without expense to the Government. The temporary buildings and utilities shall remain the property of the Contractor and shall be removed by the Contractor at its expense upon completion of the work. With the written consent of the Contracting Officer, the buildings and utilities may be abandoned and need not be removed.
- C. The Contractor shall, under regulations prescribed by the Contracting Officer, use only established roadways, or use temporary roadways constructed by the Contractor when and as authorized by the Contracting Officer. When materials are transported in prosecuting the work, vehicles shall not be loaded beyond the loading capacity recommended by the manufacturer of the vehicle or prescribed by any Federal, State, or local law or regulation. When it is necessary to cross curbs or sidewalks, the Contractor shall protect them from damage. The Contractor shall repair or pay for the repair of any damaged curbs, sidewalks, or roads.
- D. Working space and space available for storing materials shall be as determined by the Resident Engineer.
- E. Workmen are subject to rules of Medical Center applicable to their conduct.

- F. Execute work so as to interfere as little as possible with normal functioning of Medical Center as a whole, including operations of utility services, fire protection systems and any existing equipment, and with work being done by others. Use of equipment and tools that transmit vibrations and noises through the building structure, are not permitted in buildings that are occupied, during construction, jointly by patients or medical personnel, and Contractor's personnel, except as permitted by Resident Engineer where required by limited working space.
1. Do not store materials and equipment in other than assigned areas.
  2. Schedule delivery of materials and equipment to immediate construction working areas within buildings in use by Department of Veterans Affairs in quantities sufficient for not more than two work days. Provide unobstructed access to Medical Center areas required to remain in operation.
- G. Utilities Services: Where necessary to cut existing pipes, electrical wires, conduits, cables, etc., of utility services, or of fire protection systems or communications systems (except telephone), they shall be cut and capped at suitable places where shown; or, in absence of such indication, where directed by Resident Engineer. All such actions shall be coordinated with the Utility Company involved:
1. Whenever it is required that a connection fee be paid to a public utility provider for new permanent service to the construction project, for such items as water, sewer, electricity, gas or steam, payment of such fee shall be the responsibility of the Government and not the Contractor.
- H. Phasing: To insure such executions, Contractor shall furnish the Resident Engineer with a schedule of approximate dates on which the Contractor intends to accomplish work in each specific area of site, building or portion thereof. In addition, Contractor shall notify the Resident Engineer two weeks in advance of the proposed date of starting work in each specific area of site, building or portion thereof. Arrange such dates to insure accomplishment of this work in successive phases mutually agreeable to Resident Engineer and Contractor, as follows:
- 8<sup>th</sup> Floor asbestos removal, rough-in work and ceiling re-installation shall begin with the North wing and shall be completed, ready for occupancy within 90 days of NTP. The 8<sup>th</sup> floor South wing shall follow**

and shall be completed within 180 days of NTP. The 8<sup>th</sup> floor West wing shall follow and shall be completed within 270 days of NTP.

The 9<sup>th</sup> floor of Building 1 will be vacated by Government in accordance with above phasing beginning immediately after date of receipt of Notice to Proceed and turned over to the contractor.

Contractor's schedule shall comply with spec section 01 32 16.15.

- I. Construction Signs: Post construction signs at the entrances to the construction site as directed by the Resident Engineer.
- J. When a 9<sup>th</sup> floor is turned over to Contractor, Contractor shall accept entire responsibility therefore.
  - 1. Contractor shall maintain a minimum temperature of 4 degrees C (40 degrees F) at all times, except as otherwise specified.
  - 2. In connection with fire alarm equipment, Contractor shall make arrangements for pre-inspection of site with Fire Department or Company (Department of Veterans Affairs or municipal) whichever will be required to respond to an alarm from Contractor's employee or watchman.
- K. Utilities Services: Maintain existing utility services for Medical Center at all times. Provide temporary facilities, labor, materials, equipment, connections, and utilities to assure uninterrupted services. Where necessary to cut existing water, steam, gases, sewer or air pipes, or conduits, wires, cables, etc. of utility services or of fire protection systems and communications systems (including telephone), they shall be cut and capped at suitable places where shown; or, in absence of such indication, where directed by Resident Engineer.
  - 1. No utility service such as water, gas, steam, sewers or electricity, or fire protection systems and communications systems may be interrupted without prior approval of Resident Engineer. Electrical work shall be accomplished with all affected circuits or equipment de-energized. When an electrical outage cannot be accomplished, work on any energized circuits or equipment shall not commence without the Resident Engineer's prior knowledge and written approval. Refer to specification Sections 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS, 27 05 11 REQUIREMENTS FOR COMMUNICATIONS INSTALLATIONS and 28 05 11, REQUIREMENTS FOR ELECTRONIC SAFETY AND SECURITY INSTALLATIONS for additional requirements.

2. Contractor shall submit a request to interrupt any such services to Resident Engineer, in writing, 48 hours in advance of proposed interruption. Request shall state reason, date, exact time of, and approximate duration of such interruption.
  3. Contractor will be advised (in writing) of approval of request, or of which other date and/or time such interruption will cause least inconvenience to operations of Medical Center. Interruption time approved by Medical Center may occur at other than Contractor's normal working hours.
  4. Major interruptions of any system must be requested, in writing, at least 15 calendar days prior to the desired time and shall be performed as directed by the Resident Engineer.
  5. In case of a contract construction emergency, service will be interrupted on approval of Resident Engineer. Such approval will be confirmed in writing as soon as practical.
  6. Whenever it is required that a connection fee be paid to a public utility provider for new permanent service to the construction project, for such items as water, sewer, electricity, gas or steam, payment of such fee shall be the responsibility of the Government and not the Contractor.
- L. Abandoned Lines: All service lines such as wires, cables, conduits, ducts, pipes and the like, and their hangers or supports, which are to be abandoned but are not required to be entirely removed, shall be sealed, capped or plugged. The lines shall not be capped in finished areas, but shall be removed and sealed, capped or plugged in ceilings, within furred spaces, in unfinished areas, or within walls or partitions; so that they are completely behind the finished surfaces.
- M. To minimize interference of construction activities with flow of Medical Center traffic, comply with the following:
1. Keep roads, walks and entrances to grounds, to parking and to occupied areas of buildings clear of construction materials, debris and standing construction equipment and vehicles.
  2. Method and scheduling of required cutting, altering and removal of existing roads, walks and entrances must be approved by the Resident Engineer.
- N. Coordinate the work for this contract with other construction operations as directed by Resident Engineer.



**1.7 ALTERATIONS**

- A. Survey: Before any work is started, the Contractor shall make a thorough survey with the Resident Engineer and a representative of VAMC, of areas of buildings in which alterations occur and areas which are anticipated routes of access, and furnish a report, signed by all three, to the Contracting Officer. This report shall list by rooms and spaces:
1. N/A
  2. Existence and conditions of items such as plumbing fixtures and accessories, electrical fixtures, equipment, venetian blinds, shades, etc., required by drawings to be either reused or relocated, or both.
  3. Shall note any discrepancies between drawings and existing conditions at site.
  4. Shall designate areas for working space, materials storage and routes of access to areas within buildings where alterations occur and which have been agreed upon by Contractor and Resident Engineer.
- B. Any items required by drawings to be either reused or relocated or both, found during this survey to be nonexistent, or in opinion of Resident Engineer to be in such condition that their use is impossible or impractical, shall be furnished and/or replaced by Contractor with new items in accordance with specifications which will be furnished by Government. Provided the contract work is changed by reason of this subparagraph B, the contract will be modified accordingly, under provisions of clause entitled "DIFFERING SITE CONDITIONS" (FAR 52.236-2) and "CHANGES" (FAR 52.243-4 and VAAR 852.236-88).
- C. Re-Survey: Thirty days before expected partial or final inspection date, the Contractor and Resident Engineer together shall make a thorough re-survey of the areas of buildings involved. They shall furnish a report on conditions then existing, of resilient flooring, doors, windows, walls and other surfaces as compared with conditions of same as noted in first condition survey report:
1. Re-survey report shall also list any damage caused by Contractor to such flooring and other surfaces, despite protection measures; and, will form basis for determining extent of repair work required of Contractor to restore damage caused by Contractor's workmen in executing work of this contract.
- D. Protection: Provide the following protective measures:

1. Wherever existing roof surfaces are disturbed they shall be protected against water infiltration. In case of leaks, they shall be repaired immediately upon discovery.
2. Temporary protection against damage for portions of existing structures and grounds where work is to be done, materials handled and equipment moved and/or relocated.
3. Protection of interior of existing structures at all times, from damage, dust and weather inclemency. Wherever work is performed, floor surfaces that are to remain in place shall be adequately protected prior to starting work, and this protection shall be maintained intact until all work in the area is completed.

#### **1.8 INFECTION PREVENTION MEASURES**

- A. Refer to NYHHS policy for construction and Infection Control Risk Assessment (ICRA), available upon request. Implement the requirements of VAMC's ICRA team. ICRA Group may monitor dust in the vicinity of the construction work and require the Contractor to take corrective action immediately if the safe levels are exceeded.
- B. Establish and maintain a dust control program as part of the contractor's infection preventive measures in accordance with the guidelines provided by ICRA Group. Prior to start of work, prepare a plan detailing project-specific dust protection measures, including periodic status reports, and submit to Resident Engineer and Facility ICRA team for review for compliance with contract requirements in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA AND SAMPLES.
  1. All personnel involved in the construction or renovation activity shall be educated and trained in infection prevention measures established by the medical center.
- C. Medical center Infection Control personnel shall monitor for airborne disease (e.g. aspergillosis) as appropriate during construction. A baseline of conditions may be established by the medical center prior to the start of work and periodically during the construction stage to determine impact of construction activities on indoor air quality.
- D. In general, following preventive measures shall be adopted during construction to keep down dust and prevent mold.
  1. Dampen debris to keep down dust and provide temporary construction partitions in existing structures where directed by Resident

Engineer. Blank off ducts and diffusers to prevent circulation of dust into occupied areas during construction.

2. Do not perform dust producing tasks within occupied areas without the approval of the Resident Engineer. For construction in any areas that will remain jointly occupied by the medical Center and Contractor's workers, the Contractor shall:
  - a. Provide dust proof fire-rated temporary drywall construction barriers to completely separate construction from the operational areas of the hospital in order to contain dirt debris and dust. Barriers shall be sealed and made presentable on hospital occupied side. Install a self-closing rated door in a metal frame, commensurate with the partition, to allow worker access. Maintain negative air at all times. A fire retardant polystyrene, 6-mil thick or greater plastic barrier meeting local fire codes may be used where dust control is the only hazard, and an agreement is reached with the Resident Engineer and Medical Center.
  - b. HEPA filtration is required where the exhaust dust may reenter the breathing zone. Contractor shall verify that construction exhaust to exterior is not reintroduced to the medical center through intake vents, or building openings. Install HEPA (High Efficiency Particulate Accumulator) filter vacuum system rated at 95% capture of 0.3 microns including pollen, mold spores and dust particles. Insure continuous negative air pressures occurring within the work area. HEPA filters should have ASHRAE 85 or other prefilter to extend the useful life of the HEPA. Provide both primary and secondary filtrations units. Exhaust hoses shall be heavy duty, flexible steel reinforced and exhausted so that dust is not reintroduced to the medical center.
  - c. Adhesive Walk-off/Carpet Walk-off Mats, minimum 600mm x 900mm (24" x 36"), shall be used at all interior transitions from the construction area to occupied medical center area. These mats shall be changed as often as required to maintain clean work areas directly outside construction area at all times.
  - d. Vacuum and wet mop all transition areas from construction to the occupied medical center at the end of each workday. Vacuum shall utilize HEPA filtration. Maintain surrounding area frequently.

Remove debris as they are created. Transport these outside the construction area in containers with tightly fitting lids.

- e. The contractor shall not haul debris through occupied patient-care areas without prior approval of the Resident Engineer and the Medical Center. When, approved, debris shall be hauled in enclosed dust proof containers or wrapped in plastic and sealed with duct tape. No sharp objects should be allowed to cut through the plastic. Wipe down the exterior of the containers with a damp rag to remove dust. All equipment, tools, material, etc. transported through occupied areas shall be made free from dust and moisture by vacuuming and wipe down.
- f. Using a HEPA vacuum, clean inside the barrier and vacuum ceiling tile prior to replacement. Any ceiling access panels opened for investigation beyond sealed areas shall be sealed immediately when unattended.
- g. There shall be no standing water during construction. This includes water in equipment drip pans and open containers within the construction areas. All accidental spills must be cleaned up and dried within 12 hours. Remove and dispose of porous materials that remain damp for more than 72 hours.
- h. At completion, remove construction barriers and ceiling protection carefully, outside of normal work hours. Vacuum and clean all surfaces free of dust after the removal.

E. Final Cleanup:

- 1. Upon completion of project, or as work progresses, remove all construction debris from above ceiling, vertical shafts and utility chases that have been part of the construction.
- 2. Perform HEPA vacuum cleaning of all surfaces in the construction area. This includes walls, ceilings, cabinets, furniture (built-in or free standing), partitions, flooring, etc.

#### 1.9 DISPOSAL AND RETENTION

A. Materials and equipment accruing from work removed and from demolition of buildings or structures, or parts thereof, shall be disposed of as follows:

- 1. Reserved items which are to remain property of the Government are noted on drawings or in specifications as items to be stored. Items that remain property of the Government shall be removed or dislodged

from present locations in such a manner as to prevent damage which would be detrimental to re-installation and reuse. Store such items where directed by Resident Engineer.

2. Items not reserved shall become property of the Contractor and be removed by Contractor from Medical Center.
3. Items of portable equipment and furnishings located in rooms and spaces in which work is to be done under this contract shall remain the property of the Government. When rooms and spaces are vacated by the Department of Veterans Affairs during the alteration period, such items which are NOT required by drawings and specifications to be either relocated or reused will be removed by the Government in advance of work to avoid interfering with Contractor's operation.

**1.10 PROTECTION OF EXISTING VEGETATION, STRUCTURES, EQUIPMENT, UTILITIES, AND IMPROVEMENTS**

- A. The Contractor shall preserve and protect all structures, equipment, and vegetation (such as trees, shrubs, and grass) on or adjacent to the work site, which are not to be removed and which do not unreasonably interfere with the work required under this contract. The Contractor shall only remove trees when specifically authorized to do so, and shall avoid damaging vegetation that will remain in place. If any limbs or branches of trees are broken during contract performance, or by the careless operation of equipment, or by workmen, the Contractor shall trim those limbs or branches with a clean cut and paint the cut with a tree-pruning compound as directed by the Contracting Officer.
- B. The Contractor shall protect from damage all existing improvements and utilities at or near the work site and on adjacent property of a third party, the locations of which are made known to or should be known by the Contractor. The Contractor shall repair any damage to those facilities, including those that are the property of a third party, resulting from failure to comply with the requirements of this contract or failure to exercise reasonable care in performing the work. If the Contractor fails or refuses to repair the damage promptly, the Contracting Officer may have the necessary work performed and charge the cost to the Contractor.

**1.11 RESTORATION:**

- A. Remove, cut, alter, replace, patch and repair existing work as necessary to install new work. Except as otherwise shown or specified, do not cut, alter or remove any structural work, and do not disturb any

ducts, plumbing, steam, gas, or electric work without approval of the Resident Engineer. Existing work to be altered or extended and that is found to be defective in any way, shall be reported to the Resident Engineer before it is disturbed. Materials and workmanship used in restoring work, shall conform in type and quality to that of original existing construction, except as otherwise shown or specified.

- B. Upon completion of contract, deliver work complete and undamaged. Existing work (walls, ceilings, partitions, floors, mechanical and electrical work, lawns, paving, roads, walks, etc.) disturbed or removed as a result of performing required new work, shall be patched, repaired, reinstalled, or replaced with new work, and refinished and left in as good condition as existed before commencing work.
- C. At Contractor's own expense, Contractor shall immediately restore to service and repair any damage caused by Contractor's workmen to existing piping and conduits, wires, cables, etc., of utility services or of fire protection systems and communications systems (including telephone) which are indicated on drawings and which are not scheduled for discontinuance or abandonment.
- D. Expense of repairs to such utilities and systems not shown on drawings or locations of which are unknown will be covered by adjustment to contract time and price in accordance with clause entitled "CHANGES" (FAR 52.243-4 and VAAR 852.236-88) and "DIFFERING SITE CONDITIONS" (FAR 52.236-2).

**1.12 PHYSICAL DATA: N/A**

**1.13 PROFESSIONAL SURVEYING SERVICES: N/A**

**1.14 LAYOUT OF WORK: N/A**

**1.15 AS-BUILT DRAWINGS**

- A. The contractor shall maintain two full size sets of as-built drawings which will be kept current during construction of the project, to include all contract changes, modifications and clarifications.
- B. All variations shall be shown in the same general detail as used in the contract drawings. To insure compliance, as-built drawings shall be made available for the Resident Engineer's review, as often as requested.

C. Contractor shall deliver two approved completed sets of full size as-built drawings to the Resident Engineer within 15 calendar days after each completed phase and after the acceptance of the project by the Resident Engineer. An electronic copy of all documents shall be provided in AutoCAD format.

D. Paragraphs A, B, & C shall also apply to all shop drawings.

#### **1.16 USE OF ROADWAYS**

A. For hauling, use only established public roads and roads on Medical Center property and, when authorized by the Resident Engineer. When necessary to cross curbing, sidewalks, or similar construction, they must be protected by well-constructed bridges.

#### **1.17 RESIDENT ENGINEER'S FIELD OFFICE: N/A**

#### **1.18 TEMPORARY USE OF MECHANICAL AND ELECTRICAL EQUIPMENT**

A. Use of new installed mechanical and electrical equipment to provide heat, ventilation, plumbing, light and power will be permitted subject to compliance with the following provisions:

1. Permission to use each unit or system must be given by Resident Engineer. If the equipment is not installed and maintained in accordance with the following provisions, the Resident Engineer will withdraw permission for use of the equipment.
2. Electrical installations used by the equipment shall be completed in accordance with the drawings and specifications to prevent damage to the equipment and the electrical systems, i.e. transformers, relays, circuit breakers, fuses, conductors, motor controllers and their overload elements shall be properly sized, coordinated and adjusted. Voltage supplied to each item of equipment shall be verified to be correct and it shall be determined that motors are not overloaded. The electrical equipment shall be thoroughly cleaned before using it and again immediately before final inspection including vacuum cleaning and wiping clean interior and exterior surfaces.
3. Units shall be properly lubricated, balanced, and aligned. Vibrations must be eliminated.
4. Automatic temperature control systems for preheat coils shall function properly and all safety controls shall function to prevent coil freeze-up damage.
5. The air filtering system utilized shall be that which is designed for the system when complete, and all filter elements shall be

- replaced at completion of construction and prior to testing and balancing of system.
6. All components of heat production and distribution system, metering equipment, condensate returns, and other auxiliary facilities used in temporary service shall be cleaned prior to use; maintained to prevent corrosion internally and externally during use; and cleaned, maintained and inspected prior to acceptance by the Government. Boilers, pumps, feedwater heaters and auxiliary equipment must be operated as a complete system and be fully maintained by operating personnel. Boiler water must be given complete and continuous chemical treatment.
- B. Prior to final inspection, the equipment or parts used which show wear and tear beyond normal, shall be replaced with identical replacements, at no additional cost to the Government.
- C. This paragraph shall not reduce the requirements of the mechanical and electrical specifications sections.

#### **1.19 TEMPORARY USE OF EXISTING ELEVATORS**

- A. Use of existing Elevator 11 for handling building materials and Contractor's personnel daily between the hours of 5:00am and 6:30am, and from 4:30pm to 11:00pm, and for special non-recurring time intervals when permission is granted by the Resident Engineer. Elevator use will be permitted subject to following provisions:
1. Contractor makes all arrangements with the Resident Engineer for use of elevators. The Resident Engineer will ascertain that elevators are in proper condition. Personnel for operating elevators will not be provided by the Department of Veterans Affairs.
  2. Contractor covers and provides maximum protection of following elevator components:
    - a. Entrance jambs, heads soffits and threshold plates.
    - b. Entrance columns, canopy, return panels and inside surfaces of car enclosure walls.
    - c. Finish flooring.
  3. Government will accept hoisting ropes of elevator and rope of each speed governor if they are worn under normal operation. However, if these ropes are damaged by action of foreign matter such as sand, lime, grit, stones, etc., during temporary use, they shall be removed and replaced by new hoisting ropes.



4. If brake lining of elevators are excessively worn or damaged during temporary use, they shall be removed and replaced by new brake lining.
5. All parts of main controller, starter, relay panel, selector, etc., worn or damaged during temporary use shall be removed and replaced with new parts, if recommended by elevator inspector after elevator is released by Contractor.
6. Place elevator in condition equal, less normal wear, to that existing at time it was placed in service of Contractor as approved by Contracting Officer.
7. In the event of an emergency, the Medical Center may take over use of the elevator for a temporary period.
8. In addition to utilizing one of the existing interior elevator cars subject to the conditions noted above, the contractor shall provide an exterior type hoist for the purpose of transporting material, equipment and personnel at the location indicated on the contract drawings which is immediately adjacent the north exterior elevation of Building No. 1. The Contractor must ensure proper egress is maintained for ground floor entrance doors, emergency generator, and 25th Street gate at all times and will be solely responsible for the operation of the hoist. The space in the designated exterior hoist areas is limited in size and the Contractor is highly encouraged to visit the site to determine if the space is of adequate size to accommodate the hoist. The area may require modification to existing concrete walks, curbs, steps, railings, etc. in order to effectively utilize the hoist. All costs associated with the installation of the exterior hoist, as well as any necessary site work modifications including the installation of power from the nearest available electrical room, shall be borne by the Contractor and included in his bid. Hoist mechanisms, structure and supports shall have the capability of expanding to the height of the 17<sup>th</sup> floor.

**1.20 TEMPORARY USE OF NEW ELEVATORS: N/A**

**1.21 TEMPORARY TOILETS**

- A. Contractor may have for use of Contractor's workmen, such toilet accommodations as may be assigned to Contractor by Medical Center. Contractor shall keep such places clean and be responsible for any

damage done thereto by Contractor's workmen. Failure to maintain satisfactory condition in toilets will deprive Contractor of the privilege to use such toilets.

#### 1.22 AVAILABILITY AND USE OF UTILITY SERVICES

- A. The Government shall make all reasonably required amounts of utilities available to the Contractor from existing outlets and supplies, as specified in the contract. The amount to be paid by the Contractor for chargeable electrical services shall be the prevailing rates charged to the Government. The Contractor shall carefully conserve any utilities furnished without charge.
- B. The Contractor, at Contractor's expense and in a workmanlike manner satisfactory to the Contracting Officer, shall install and maintain all necessary temporary connections and distribution lines, and all meters required to measure the amount of electricity used for the purpose of determining charges. Before final acceptance of the work by the Government, the Contractor shall remove all the temporary connections, distribution lines, meters, and associated paraphernalia.
- C. Contractor shall install meters at Contractor's expense and furnish the Medical Center.
- D. Heat: Furnish temporary heat necessary to prevent injury to work and materials through dampness and cold. Use of open salamanders or any temporary heating devices which may be fire hazards or may smoke and damage finished work, will not be permitted.
- E. Electricity (for Construction and Testing): Furnish all temporary electric services.
  - 1. Obtain electricity by connecting to the Medical Center electrical distribution system. The Contractor shall meter and pay for electricity required for electric cranes and hoisting devices, electrical welding devices and any electrical heating devices providing temporary heat. Electricity for all other uses is available at no cost to the Contractor.
- F. Water (for Construction and Testing): Furnish temporary water service.
  - 1. Obtain water by connecting to the Medical Center water distribution system. Provide reduced pressure backflow preventer at each connection. Water is available at no cost to the Contractor.
  - 2. Maintain connections, pipe, fittings and fixtures and conserve water-use so none is wasted. Failure to stop leakage or other wastes

will be cause for revocation (at Resident Engineer's discretion) of use of water from Medical Center's system.

G. Steam: Furnish steam system for testing required in various sections of specifications.

1. Obtain steam for testing by connecting to the Medical Center distribution system. Steam is available at no cost to the Contractor.
2. Maintain connections, pipe, fittings and fixtures and conserve steam-use so none is wasted. Failure to stop leakage or other waste will be cause for revocation (at Resident Engineer's discretion), of use of steam from the Medical Center's system.

**1.23 NEW TELEPHONE EQUIPMENT: N/A**

**1.24 TESTS: N/A**

**1.25 INSTRUCTIONS: N/A**

**1.26 GOVERNMENT-FURNISHED PROPERTY: N/A**

**1.27 RELOCATED ITEMS: N/A**

**1.28 STORAGE SPACE FOR DEPARTMENT OF VETERANS AFFAIRS EQUIPMENT: N/A**

**1.29 CONSTRUCTION SIGN: N/A**

**1.30 SAFETY SIGN: N/A**

**1.31 PHOTOGRAPHIC DOCUMENTATION:** The contractor shall provide photographic documentation of construction progress and critical subsurface utilities using the VA-approved photographic documentation service.

**1.32 FINAL ELEVATION DIGITAL IMAGES: N/A**

**1.33 HISTORIC PRESERVATION: N/A**

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**SECTION 01 32 16.15**  
**PROJECT SCHEDULES**  
*(SMALL PROJECTS - DESIGN/BID/BUILD)*

**PART 1- GENERAL**

**1.1 DESCRIPTION:**

- A. The Contractor shall develop a Critical Path Method (CPM) plan and schedule demonstrating fulfillment of the contract requirements (Project Schedule), and shall keep the Project Schedule up-to-date in accordance with the requirements of this section and shall utilize the plan for scheduling, coordinating and monitoring work under this contract (including all activities of subcontractors, equipment vendors and suppliers). Conventional Critical Path Method (CPM) technique shall be utilized to satisfy both time and cost applications.

**1.2 CONTRACTOR'S REPRESENTATIVE:**

- A. The Contractor shall designate an authorized representative responsible for the Project Schedule including preparation, review and progress reporting with and to the Contracting Officer's Representative (COTR).
- B. The Contractor's representative shall have direct project control and complete authority to act on behalf of the Contractor in fulfilling the requirements of this specification section.
- C. The Contractor's representative shall have the option of developing the project schedule within their organization or to engage the services of an outside consultant. If an outside scheduling consultant is utilized, Section 1.3 of this specification will apply.

**1.3 CONTRACTOR'S CONSULTANT:**

- A. The Contractor shall submit a qualification proposal to the COTR, within 10 days of bid acceptance. The qualification proposal shall include:
1. The name and address of the proposed consultant.
  2. Information to show that the proposed consultant has the qualifications to meet the requirements specified in the preceding paragraph.
  3. A representative sample of prior construction projects, which the proposed consultant has performed complete project scheduling services. These representative samples shall be of similar size and scope.

- B. The Contracting Officer has the right to approve or disapprove the proposed consultant, and will notify the Contractor of the VA decision within seven calendar days from receipt of the qualification proposal. In case of disapproval, the Contractor shall resubmit another consultant within 10 calendar days for renewed consideration. The Contractor shall have their scheduling consultant approved prior to submitting any schedule for approval.

#### **1.4 COMPUTER PRODUCED SCHEDULES**

- A. The contractor shall provide monthly, to the Department of Veterans Affairs (VA), all computer-produced time/cost schedules and reports generated from monthly project updates. This monthly computer service will include: three copies of up to five different reports (inclusive of all pages) available within the user defined reports of the scheduling software approved by the Contracting Officer; a hard copy listing of all project schedule changes, and associated data, made at the update and an electronic file of this data; and the resulting monthly updated schedule in PDM format. These must be submitted with and substantively support the contractor's monthly payment request and the signed look ahead report. The COTR shall identify the five different report formats that the contractor shall provide.
- B. The contractor shall be responsible for the correctness and timeliness of the computer-produced reports. The Contractor shall also responsible for the accurate and timely submittal of the updated project schedule and all CPM data necessary to produce the computer reports and payment request that is specified.
- C. The VA will report errors in computer-produced reports to the Contractor's representative within ten calendar days from receipt of reports. The Contractor shall reprocess the computer-produced reports and associated diskette(s), when requested by the Contracting Officer's representative, to correct errors which affect the payment and schedule for the project.

#### **1.5 THE COMPLETE PROJECT SCHEDULE SUBMITTAL**

- A. Within 45 calendar days after receipt of Notice to Proceed, the Contractor shall submit for the Contracting Officer's review; three blue line copies of the interim schedule on sheets of paper 765 x 1070 mm (30 x 42 inches) and an electronic file in the previously approved CPM schedule program. The submittal shall also include three copies of a computer-produced activity/event ID schedule showing project

duration; phase completion dates; and other data, including event cost. Each activity/event on the computer-produced schedule shall contain as a minimum, but not limited to, activity/event ID, activity/event description, duration, budget amount, early start date, early finish date, late start date, late finish date and total float. Work activity/event relationships shall be restricted to finish-to-start or start-to-start without lead or lag constraints. Activity/event date constraints, not required by the contract, will not be accepted unless submitted to and approved by the Contracting Officer. The contractor shall make a separate written detailed request to the Contracting Officer identifying these date constraints and secure the Contracting Officer's written approval before incorporating them into the network diagram. The Contracting Officer's separate approval of the Project Schedule shall not excuse the contractor of this requirement. Logic events (non-work) will be permitted where necessary to reflect proper logic among work events, but must have zero duration. The complete working schedule shall reflect the Contractor's approach to scheduling the complete project. **The final Project Schedule in its original form shall contain no contract changes or delays which may have been incurred during the final network diagram development period and shall reflect the entire contract duration as defined in the bid documents.** These changes/delays shall be entered at the first update after the final Project Schedule has been approved. The Contractor should provide their requests for time and supporting time extension analysis for contract time as a result of contract changes/delays, after this update, and in accordance with Article, ADJUSTMENT OF CONTRACT COMPLETION.

- D. Within 30 calendar days after receipt of the complete project interim Project Schedule and the complete final Project Schedule, the Contracting Officer or his representative, will do one or both of the following:
1. Notify the Contractor concerning his actions, opinions, and objections.
  2. A meeting with the Contractor at or near the job site for joint review, correction or adjustment of the proposed plan will be scheduled if required. Within 14 calendar days after the joint review, the Contractor shall revise and shall submit three blue line copies of the revised Project Schedule, three copies of the revised

computer-produced activity/event ID schedule and a revised electronic file as specified by the Contracting Officer. The revised submission will be reviewed by the Contracting Officer and, if found to be as previously agreed upon, will be approved.

- E. The approved baseline schedule and the computer-produced schedule(s) generated there from shall constitute the approved baseline schedule until subsequently revised in accordance with the requirements of this section.
- F. The Complete Project Network Schedule shall contain sufficient level of detailed work activities/events (following all requirements of item 1.7 below), to represent realistic work plan / sequence of construction and the critical path(s) to maintain the project schedule and monthly updates.

#### **1.6 WORK ACTIVITY/EVENT COST DATA**

- A. The Contractor shall cost load all work activities/events except procurement activities. The cumulative amount of all cost loaded work activities/events (including alternates) shall equal the total contract price. Prorate overhead, profit and general conditions on all work activities/events for the entire project length. The contractor shall generate from this information cash flow curves indicating graphically the total percentage of work activity/event dollar value scheduled to be in place on early finish, late finish. These cash flow curves will be used by the Contracting Officer to assist him in determining approval or disapproval of the cost loading. Negative work activity/event cost data will not be acceptable, except on VA issued contract changes.
- B. The Contractor shall cost load work activities/events for guarantee period services, test, balance and adjust various systems in accordance with the provisions in Article, FAR 52.232 - 5 (PAYMENT UNDER FIXED-PRICE CONSTRUCTION CONTRACTS) and VAAR 852.236 - 83 (PAYMENT UNDER FIXED-PRICE CONSTRUCTION CONTRACTS).
- C. In accordance with FAR 52.236 - 1 (PERFORMANCE OF WORK BY THE CONTRACTOR) and VAAR 852.236 - 72 (PERFORMANCE OF WORK BY THE CONTRACTOR), the Contractor shall submit, simultaneously with the cost per work activity/event of the construction schedule required by this Section, a responsibility code for all activities/events of the project for which the Contractor's forces will perform the work.



- D. The Contractor shall cost load work activities/events for all BID ITEMS including ASBESTOS ABATEMENT. The sum of each BID ITEM work shall equal the value of the bid item in the Contractors' bid.

#### **1.7 PROJECT SCHEDULE REQUIREMENTS**

- A. Show on the project schedule the sequence of work activities/events required for complete performance of all items of work. The Contractor Shall:
1. Show activities/events as:
    - a. Contractor's time required for submittal of shop drawings, templates, fabrication, delivery and similar pre-construction work.
    - b. Contracting Officer's and Architect-Engineer's review and approval of shop drawings, equipment schedules, samples, template, or similar items.
    - c. Interruption of VA Facilities utilities, delivery of Government furnished equipment, and rough-in drawings, project phasing and any other specification requirements.
    - d. Test, balance and adjust various systems and pieces of equipment, maintenance and operation manuals, instructions and preventive maintenance tasks.
    - e. VA inspection and acceptance activity/event with a minimum duration of five work days at the end of each phase and immediately preceding any VA move activity/event required by the contract phasing for that phase.
  2. Show not only the activities/events for actual construction work for each trade category of the project, but also trade relationships to indicate the movement of trades from one area, floor, or building, to another area, floor, or building, for at least five trades who are performing major work under this contract.
  3. Break up the work into activities/events of a duration no longer than 20 work days each or one reporting period, except as to non-construction activities/events (i.e., procurement of materials, delivery of equipment, concrete and asphalt curing) and any other activities/events for which the COTR may approve the showing of a longer duration. The duration for VA approval of any required submittal, shop drawing, or other submittals will not be less than 20 work days.

4. Describe work activities/events clearly, so the work is readily identifiable for assessment of completion. Activities/events labeled "start," "continue," or "completion," are not specific and will not be allowed. Lead and lag time activities will not be acceptable.
  5. The schedule shall be generally numbered in such a way to reflect discipline, phase or location of the work.
- B. The Contractor shall submit the following supporting data in addition to the project schedule:
1. The appropriate project calendar including working days and holidays.
  2. The planned number of shifts per day.
  3. The number of hours per shift.
- Failure of the Contractor to include this data shall delay the review of the submittal until the Contracting Officer is in receipt of the missing data.
- C. To the extent that the Project Schedule or any revised Project Schedule shows anything not jointly agreed upon, it shall not be deemed to have been approved by the COTR. Failure to include any element of work required for the performance of this contract shall not excuse the Contractor from completing all work required within any applicable completion date of each phase regardless of the COTR's approval of the Project Schedule.
- D. Compact Disk Requirements and CPM Activity/Event Record Specifications: Submit to the VA an electronic file(s) containing one file of the data required to produce a schedule, reflecting all the activities/events of the complete project schedule being submitted.

#### **1.8 PAYMENT TO THE CONTRACTOR:**

- A. Monthly, the contractor shall submit the AIA application and certificate for payment documents G702 & G703 reflecting updated schedule activities and cost data in accordance with the provisions of the following Article, PAYMENT AND PROGRESS REPORTING, as the basis upon which progress payments will be made pursuant to Article, FAR 52.232 - 5 (PAYMENT UNDER FIXED-PRICE CONSTRUCTION CONTRACTS) and VAAR 852.236 - 83 (PAYMENT UNDER FIXED-PRICE CONSTRUCTION CONTRACTS). The Contractor shall be entitled to a monthly progress payment upon approval of estimates as determined from the currently approved updated project schedule. Monthly payment requests shall include: a listing of

all agreed upon project schedule changes and associated data; and an electronic file (s) of the resulting monthly updated schedule.

- B. Approval of the Contractor's monthly Application for Payment shall be contingent, among other factors, on the submittal of a satisfactory monthly update of the project schedule.

#### **1.9 PAYMENT AND PROGRESS REPORTING**

- A. Monthly schedule update meetings will be held on dates mutually agreed to by the COTR and the Contractor. Contractor and their CPM consultant (if applicable) shall attend all monthly schedule update meetings. The Contractor shall accurately update the Project Schedule and all other data required and provide this information to the COTR three work days in advance of the schedule update meeting. Job progress will be reviewed to verify:
  - 1. Actual start and/or finish dates for updated/completed activities/events.
  - 2. Remaining duration for each activity/event started, or scheduled to start, but not completed.
  - 3. Logic, time and cost data for change orders, and supplemental agreements that are to be incorporated into the Project Schedule.
  - 4. Changes in activity/event sequence and/or duration which have been made, pursuant to the provisions of following Article, ADJUSTMENT OF CONTRACT COMPLETION.
  - 5. Completion percentage for all completed and partially completed activities/events.
  - 6. Logic and duration revisions required by this section of the specifications.
  - 7. Activity/event duration and percent complete shall be updated independently.
- B. After completion of the joint review, the contractor shall generate an updated computer-produced calendar-dated schedule and supply the Contracting Officer's representative with reports in accordance with the Article, COMPUTER PRODUCED SCHEDULES, specified.
- C. **Parallel Run / Time Impact Analysis** - After completing the monthly schedule update, the contractor's representative or scheduling consultant shall rerun (Parallel run) all current period contract change(s) against the prior approved monthly project schedule. The analysis shall only include original workday durations and schedule logic and durations (Fragnets) agreed upon by the contractor and

resident engineer for the contract change(s). RFI, response time or waiting period etc. are not allowed in the CO Fragnet logic; only approved physical work activities should be included. When there is a disagreement on logic and/or durations, the Contractor shall use the schedule logic and/or durations provided and approved by the resident engineer. After each parallel run update, the resulting electronic project schedule data file shall be appropriately identified and submitted to the VA in accordance to the requirements listed in articles 1.4 and 1.7. This electronic submission is separate from the regular monthly project schedule update requirements and shall be submitted to the resident engineer within fourteen (14) calendar days of completing the regular schedule update. **Before inserting the contract changes durations, care must be taken to ensure that only the original durations will be used for the analysis, not the reported durations after progress. In addition, once the final network diagram is approved, the contractor must recreate all manual progress payment updates on this approved network diagram and associated reruns for contract changes in each of these update periods as outlined above for regular update periods. This will require detailed record keeping for each of the manual progress payment updates.**

- D. Following approval of the CPM schedule, the VA, the General Contractor, its approved CPM Consultant, RE office representatives, and all subcontractors needed, as determined by the SRE, shall meet to discuss the monthly updated schedule. The main emphasis shall be to address work activities to avoid slippage of project schedule and to identify any necessary actions required to maintain project schedule during the reporting period. The Government representatives and the Contractor should conclude the meeting with a clear understanding of those work and administrative actions necessary to maintain project schedule status during the reporting period. This schedule coordination meeting will occur after each monthly project schedule update meeting utilizing the resulting schedule reports from that schedule update. If the project is behind schedule, discussions should include ways to prevent further slippage as well as ways to improve the project schedule status, when appropriate.

**1.10 RESPONSIBILITY FOR COMPLETION**

- A. If it becomes apparent from the current revised monthly progress schedule that phasing or contract completion dates will not be met, the Contractor shall execute some or all of the following remedial actions:
  - 1. Increase construction manpower in such quantities and crafts as necessary to eliminate the backlog of work.
  - 2. Increase the number of working hours per shift, shifts per working day, working days per week, the amount of construction equipment, or any combination of the foregoing to eliminate the backlog of work.
  - 3. Reschedule the work in conformance with the specification requirements.
- B. Prior to proceeding with any of the above actions, the Contractor shall notify and obtain approval from the COTR for the proposed schedule changes. If such actions are approved, the representative schedule revisions shall be incorporated by the Contractor into the Project Schedule before the next update, at no additional cost to the Government.

**1.11 CHANGES TO THE SCHEDULE**

- A. Within 30 calendar days after VA acceptance and approval of any updated project schedule, the Contractor shall submit a revised electronic file (s) and a list of any activity/event changes including predecessors and successors for any of the following reasons:
  - 1. Delay in completion of any activity/event or group of activities/events, which may be involved with contract changes, strikes, unusual weather, and other delays will not relieve the Contractor from the requirements specified unless the conditions are shown on the CPM as the direct cause for delaying the project beyond the acceptable limits.
  - 2. Delays in submittals, or deliveries, or work stoppage are encountered which make rescheduling of the work necessary.
  - 3. The schedule does not represent the actual prosecution and progress of the project.
  - 4. When there is, or has been, a substantial revision to the activity/event costs regardless of the cause for these revisions.
- B. CPM revisions made under this paragraph which affect the previously approved computer-produced schedules for Government furnished equipment, vacating of areas by the VA Facility, contract phase(s) and sub phase(s), utilities furnished by the Government to the Contractor,

or any other previously contracted item, shall be furnished in writing to the Contracting Officer for approval.

- C. Contracting Officer's approval for the revised project schedule and all relevant data is contingent upon compliance with all other paragraphs of this section and any other previous agreements by the Contracting Officer or the VA representative.
- D. The cost of revisions to the project schedule resulting from contract changes will be included in the proposal for changes in work as specified in FAR 52.243 - 4 (Changes) and VAAR 852.236 - 88 (Changes - Supplemental), and will be based on the complexity of the revision or contract change, man hours expended in analyzing the change, and the total cost of the change.
- E. The cost of revisions to the Project Schedule not resulting from contract changes is the responsibility of the Contractor.

#### **1.12 ADJUSTMENT OF CONTRACT COMPLETION**

- A. The contract completion time will be adjusted only for causes specified in this contract. Request for an extension of the contract completion date by the Contractor shall be supported with a justification, CPM data and supporting evidence as the COTR may deem necessary for determination as to whether or not the Contractor is entitled to an extension of time under the provisions of the contract. Submission of proof based on revised activity/event logic, durations (in work days) and costs is obligatory to any approvals. The schedule must clearly display that the Contractor has used, in full, all the float time available for the work involved in this request. The Contracting Officer's determination as to the total number of days of contract extension will be based upon the current computer-produced calendar-dated schedule for the time period in question and all other relevant information.
- B. Actual delays in activities/events which, according to the computer-produced calendar-dated schedule, do not affect the extended and predicted contract completion dates shown by the critical path in the network, will not be the basis for a change to the contract completion date. The Contracting Officer will within a reasonable time after receipt of such justification and supporting evidence, review the facts and advise the Contractor in writing of the Contracting Officer's decision.

- C. The Contractor shall submit each request for a change in the contract completion date to the Contracting Officer in accordance with the provisions specified under FAR 52.243 - 4 (Changes) and VAAR 852.236 - 88 (Changes - Supplemental). The Contractor shall include, as a part of each change order proposal, a sketch showing all CPM logic revisions, duration (in work days) changes, and cost changes, for work in question and its relationship to other activities on the approved network diagram.
- D. All delays due to non-work activities/events such as RFI's, WEATHER, STRIKES, and similar non-work activities/events shall be analyzed on a month by month basis.

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**SECTION 01 33 23**  
**SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES**

- 1-1. Refer to Articles titled SPECIFICATIONS AND DRAWINGS FOR CONSTRUCTION (FAR 52.236-21) and, SPECIAL NOTES (VAAR 852.236-91), in GENERAL CONDITIONS.
- 1-2. For the purposes of this contract, samples, test reports, certificates, and manufacturers' literature and data shall also be subject to the previously referenced requirements. The following text refers to all items collectively as SUBMITTALS.
- 1-3. Submit for approval, all of the items specifically mentioned under the separate sections of the specification, with information sufficient to evidence full compliance with contract requirements. Materials, fabricated articles and the like to be installed in permanent work shall equal those of approved submittals. After an item has been approved, no change in brand or make will be permitted unless:
  - A. Satisfactory written evidence is presented to, and approved by Contracting Officer, that manufacturer cannot make scheduled delivery of approved item or;
  - B. Item delivered has been rejected and substitution of a suitable item is an urgent necessity or;
  - C. Other conditions become apparent which indicates approval of such substitute item to be in best interest of the Government.
- 1-4. Forward submittals in sufficient time to permit proper consideration and approval action by Government. Time submission to assure adequate lead time for procurement of contract - required items. Delays attributable to untimely and rejected submittals will not serve as a basis for extending contract time for completion.
- 1-5. Submittals will be reviewed for compliance with contract requirements by Architect-Engineer, and action thereon will be taken by Resident Engineer on behalf of the Contracting Officer.
- 1-6. Upon receipt of submittals, Architect-Engineer will assign a file number thereto. Contractor, in any subsequent correspondence, shall refer to this file and identification number to expedite replies relative to previously approved or disapproved submittals.
- 1-7. The Government reserves the right to require additional submittals, whether or not particularly mentioned in this contract. If additional submittals beyond those required by the contract are furnished pursuant to request therefor by Contracting Officer, adjustment in contract price

and time will be made in accordance with Articles titled CHANGES (FAR 52.243-4) and CHANGES - SUPPLEMENT (VAAR 852.236-88) of the GENERAL CONDITIONS.

- 1-8. Schedules called for in specifications and shown on shop drawings shall be submitted for use and information of Department of Veterans Affairs and Architect-Engineer. However, the Contractor shall assume responsibility for coordinating and verifying schedules. The Contracting Officer and Architect- Engineer assumes no responsibility for checking schedules or layout drawings for exact sizes, exact numbers and detailed positioning of items.
- 1-9. Submittals must be submitted by Contractor only and shipped prepaid. Contracting Officer assumes no responsibility for checking quantities or exact numbers included in such submittals.
  - A. Submit samples required by Section 09 06 00, SCHEDULE FOR FINISHES, in quadruplicate. Submit other samples in single units unless otherwise specified. Submit shop drawings, schedules, manufacturers' literature and data, and certificates in quadruplicate, except where a greater number is specified.
  - B. Submittals will receive consideration only when covered by a transmittal letter signed by Contractor. Letter shall be sent via first class mail and shall contain the list of items, name of Medical Center, name of Contractor, contract number, applicable specification paragraph numbers, applicable drawing numbers (and other information required for exact identification of location for each item), manufacturer and brand, ASTM or Federal Specification Number (if any) and such additional information as may be required by specifications for particular item being furnished. In addition, catalogs shall be marked to indicate specific items submitted for approval.
    1. A copy of letter must be enclosed with items, and any items received without identification letter will be considered "unclaimed goods" and held for a limited time only.
    2. Each sample, certificate, manufacturers' literature and data shall be labeled to indicate the name and location of the Medical Center, name of Contractor, manufacturer, brand, contract number and ASTM or Federal Specification Number as applicable and location(s) on project.
    3. Required certificates shall be signed by an authorized representative of manufacturer or supplier of material, and by Contractor.

- C. If submittal samples have been disapproved, resubmit new samples as soon as possible after notification of disapproval. Such new samples shall be marked "Resubmitted Sample" in addition to containing other previously specified information required on label and in transmittal letter.
- D. Approved samples will be kept on file by the Resident Engineer at the site until completion of contract, at which time such samples will be delivered to Contractor as Contractor's property. Where noted in technical sections of specifications, approved samples in good condition may be used in their proper locations in contract work. At completion of contract, samples that are not approved will be returned to Contractor only upon request and at Contractor's expense. Such request should be made prior to completion of the contract. Disapproved samples that are not requested for return by Contractor will be discarded after completion of contract.
- E. Submittal drawings (shop, erection or setting drawings) and schedules, required for work of various trades, shall be checked before submission by technically qualified employees of Contractor for accuracy, completeness and compliance with contract requirements. These drawings and schedules shall be stamped and signed by Contractor certifying to such check.
  - 1. For each drawing required, submit one legible photographic paper or vellum reproducible.
  - 2. Reproducible shall be full size.
  - 3. Each drawing shall have marked thereon, proper descriptive title, including Medical Center location, project number, manufacturer's number, reference to contract drawing number, detail Section Number, and Specification Section Number.
  - 4. A space 120 mm by 125 mm (4-3/4 by 5 inches) shall be reserved on each drawing to accommodate approval or disapproval stamp.
  - 5. Submit drawings, ROLLED WITHIN A MAILING TUBE, fully protected for shipment.
  - 6. One reproducible print of approved or disapproved shop drawings will be forwarded to Contractor.
  - 7. When work is directly related and involves more than one trade, shop drawings shall be submitted to Architect-Engineer under one cover.
- 1-10. Samples shop drawings, test reports, certificates and manufacturers' literature and data, shall be submitted for approval to

Cannon Design

360 Madison Avenue, 11<sup>th</sup> Floor

New York City, NY 10017

1-11. At the time of transmittal to the Architect-Engineer, the Contractor shall also send a copy of the complete submittal directly to the Resident Engineer.

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**SECTION 01 42 19**  
**REFERENCE STANDARDS**

**PART 1 - GENERAL****1.1 DESCRIPTION**

This section specifies the availability and source of references and standards specified in the project manual under paragraphs APPLICABLE PUBLICATIONS and/or shown on the drawings.

**1.2 AVAILABILITY OF SPECIFICATIONS LISTED IN THE GSA INDEX OF FEDERAL SPECIFICATIONS, STANDARDS AND COMMERCIAL ITEM DESCRIPTIONS FPMR PART 101-29 (FAR 52.211-1) (AUG 1998)**

- A. The GSA Index of Federal Specifications, Standards and Commercial Item Descriptions, FPMR Part 101-29 and copies of specifications, standards, and commercial item descriptions cited in the solicitation may be obtained for a fee by submitting a request to - GSA Federal Supply Service, Specifications Section, Suite 8100, 470 East L'Enfant Plaza, SW, Washington, DC 20407, Telephone (202) 619-8925, Facsimile (202) 619-8978.
- B. If the General Services Administration, Department of Agriculture, or Department of Veterans Affairs issued this solicitation, a single copy of specifications, standards, and commercial item descriptions cited in this solicitation may be obtained free of charge by submitting a request to the addressee in paragraph (a) of this provision. Additional copies will be issued for a fee.

**1.3 AVAILABILITY FOR EXAMINATION OF SPECIFICATIONS NOT LISTED IN THE GSA INDEX OF FEDERAL SPECIFICATIONS, STANDARDS AND COMMERCIAL ITEM DESCRIPTIONS (FAR 52.211-4) (JUN 1988)**

The specifications and standards cited in this solicitation can be examined at the following location:

DEPARTMENT OF VETERANS AFFAIRS

Office of Construction & Facilities Management

Facilities Quality Service (00CFM1A)

425 Eye Street N.W, (sixth floor)

Washington, DC 20001

Telephone Numbers: (202) 632-5249 or (202) 632-5178

Between 9:00 AM - 3:00 PM

**1.4 AVAILABILITY OF SPECIFICATIONS NOT LISTED IN THE GSA INDEX OF FEDERAL SPECIFICATIONS, STANDARDS AND COMMERCIAL ITEM DESCRIPTIONS (FAR 52.211-3) (JUN 1988)**

The specifications cited in this solicitation may be obtained from the associations or organizations listed below.

AA Aluminum Association Inc.

<http://www.aluminum.org>

AABC Associated Air Balance Council  
<http://www.aabchq.com>

AAMA American Architectural Manufacturer's Association  
<http://www.aamanet.org>

AAN American Nursery and Landscape Association  
<http://www.anla.org>

AASHTO American Association of State Highway and Transportation Officials  
<http://www.aashto.org>

AATCC American Association of Textile Chemists and Colorists  
<http://www.aatcc.org>

ACGIH American Conference of Governmental Industrial Hygienists  
<http://www.acgih.org>

ACI American Concrete Institute  
<http://www.aci-int.net>

ACPA American Concrete Pipe Association  
<http://www.concrete-pipe.org>

ACPPA American Concrete Pressure Pipe Association  
<http://www.acppa.org>

ADC Air Diffusion Council  
<http://flexibleduct.org>

AGA American Gas Association  
<http://www.aga.org>

AGC Associated General Contractors of America  
<http://www.agc.org>

AGMA American Gear Manufacturers Association, Inc.  
<http://www.agma.org>

AHAM Association of Home Appliance Manufacturers  
<http://www.aham.org>

AISC American Institute of Steel Construction  
<http://www.aisc.org>

AISI American Iron and Steel Institute  
<http://www.steel.org>

AITC American Institute of Timber Construction  
<http://www.aitc-glulam.org>

AMCA Air Movement and Control Association, Inc.  
<http://www.amca.org>

ANLA American Nursery & Landscape Association  
<http://www.anla.org>

ANSI American National Standards Institute, Inc.  
<http://www.ansi.org>

APA	The Engineered Wood Association <a href="http://www.apawood.org">http://www.apawood.org</a>
ARI	Air-Conditioning and Refrigeration Institute <a href="http://www.ari.org">http://www.ari.org</a>
ASAE	American Society of Agricultural Engineers <a href="http://www.asae.org">http://www.asae.org</a>
ASCE	American Society of Civil Engineers <a href="http://www.asce.org">http://www.asce.org</a>
ASHRAE	American Society of Heating, Refrigerating, and Air-Conditioning Engineers <a href="http://www.ashrae.org">http://www.ashrae.org</a>
ASME	American Society of Mechanical Engineers <a href="http://www.asme.org">http://www.asme.org</a>
ASSE	American Society of Sanitary Engineering <a href="http://www.asse-plumbing.org">http://www.asse-plumbing.org</a>
ASTM	American Society for Testing and Materials <a href="http://www.astm.org">http://www.astm.org</a>
AWI	Architectural Woodwork Institute <a href="http://www.awinet.org">http://www.awinet.org</a>
AWS	American Welding Society <a href="http://www.aws.org">http://www.aws.org</a>
AWWA	American Water Works Association <a href="http://www.awwa.org">http://www.awwa.org</a>
BHMA	Builders Hardware Manufacturers Association <a href="http://www.buildershardware.com">http://www.buildershardware.com</a>
BIA	Brick Institute of America <a href="http://www.bia.org">http://www.bia.org</a>
CAGI	Compressed Air and Gas Institute <a href="http://www.cagi.org">http://www.cagi.org</a>
CGA	Compressed Gas Association, Inc. <a href="http://www.cganet.com">http://www.cganet.com</a>
CI	The Chlorine Institute, Inc. <a href="http://www.chlorineinstitute.org">http://www.chlorineinstitute.org</a>
CISCA	Ceilings and Interior Systems Construction Association <a href="http://www.cisca.org">http://www.cisca.org</a>
CISPI	Cast Iron Soil Pipe Institute <a href="http://www.cispi.org">http://www.cispi.org</a>
CLFMI	Chain Link Fence Manufacturers Institute <a href="http://www.chainlinkinfo.org">http://www.chainlinkinfo.org</a>
CPMB	Concrete Plant Manufacturers Bureau <a href="http://www.cpmc.org">http://www.cpmc.org</a>

CRA	California Redwood Association <a href="http://www.calredwood.org">http://www.calredwood.org</a>
CRSI	Concrete Reinforcing Steel Institute <a href="http://www.crsi.org">http://www.crsi.org</a>
CTI	Cooling Technology Institute <a href="http://www.cti.org">http://www.cti.org</a>
DHI	Door and Hardware Institute <a href="http://www.dhi.org">http://www.dhi.org</a>
EGSA	Electrical Generating Systems Association <a href="http://www.egsa.org">http://www.egsa.org</a>
EEI	Edison Electric Institute <a href="http://www.eei.org">http://www.eei.org</a>
EPA	Environmental Protection Agency <a href="http://www.epa.gov">http://www.epa.gov</a>
ETL	ETL Testing Laboratories, Inc. <a href="http://www.etl.com">http://www.etl.com</a>
FAA	Federal Aviation Administration <a href="http://www.faa.gov">http://www.faa.gov</a>
FCC	Federal Communications Commission <a href="http://www.fcc.gov">http://www.fcc.gov</a>
FPS	The Forest Products Society <a href="http://www.forestprod.org">http://www.forestprod.org</a>
GANA	Glass Association of North America <a href="http://www.cssinfo.com/info/gana.html/">http://www.cssinfo.com/info/gana.html/</a>
FM	Factory Mutual Insurance <a href="http://www.fmglobal.com">http://www.fmglobal.com</a>
GA	Gypsum Association <a href="http://www.gypsum.org">http://www.gypsum.org</a>
GSA	General Services Administration <a href="http://www.gsa.gov">http://www.gsa.gov</a>
HI	Hydraulic Institute <a href="http://www.pumps.org">http://www.pumps.org</a>
HPVA	Hardwood Plywood & Veneer Association <a href="http://www.hpva.org">http://www.hpva.org</a>
ICBO	International Conference of Building Officials <a href="http://www.icbo.org">http://www.icbo.org</a>
ICEA	Insulated Cable Engineers Association Inc. <a href="http://www.icea.net">http://www.icea.net</a>
\ICAC	Institute of Clean Air Companies <a href="http://www.icac.com">http://www.icac.com</a>



IEEE Institute of Electrical and Electronics Engineers  
<http://www.ieee.org/>

IMSA International Municipal Signal Association  
<http://www.imsasafety.org>

IPCEA Insulated Power Cable Engineers Association

NBMA Metal Buildings Manufacturers Association  
<http://www.mbma.com>

MSS Manufacturers Standardization Society of the Valve and Fittings Industry Inc.  
<http://www.mss-hq.com>

NAAMM National Association of Architectural Metal Manufacturers  
<http://www.naamm.org>

NAPHCC Plumbing-Heating-Cooling Contractors Association  
<http://www.phccweb.org.org>

NBS National Bureau of Standards  
See - NIST

NBBPVI National Board of Boiler and Pressure Vessel Inspectors  
<http://www.nationboard.org>

NEC National Electric Code  
See - NFPA National Fire Protection Association

NEMA National Electrical Manufacturers Association  
<http://www.nema.org>

NFPA National Fire Protection Association  
<http://www.nfpa.org>

NHLA National Hardwood Lumber Association  
<http://www.natlhardwood.org>

NIH National Institute of Health  
<http://www.nih.gov>

NIST National Institute of Standards and Technology  
<http://www.nist.gov>

NLMA Northeastern Lumber Manufacturers Association, Inc.  
<http://www.nelma.org>

NPA National Particleboard Association  
18928 Premiere Court  
Gaithersburg, MD 20879  
(301) 670-0604

NSF National Sanitation Foundation  
<http://www.nsf.org>

NWWDA Window and Door Manufacturers Association  
<http://www.nwwda.org>

OSHA      Occupational Safety and Health Administration  
Department of Labor  
<http://www.osha.gov>

PCA      Portland Cement Association  
<http://www.portcement.org>

PCI      Precast Prestressed Concrete Institute  
<http://www.pci.org>

PPI      The Plastic Pipe Institute  
<http://www.plasticpipe.org>

PEI      Porcelain Enamel Institute, Inc.  
<http://www.porcelainenamel.com>

PTI      Post-Tensioning Institute  
<http://www.post-tensioning.org>

RFCI      The Resilient Floor Covering Institute  
<http://www.rfci.com>

RIS      Redwood Inspection Service  
See - CRA

RMA      Rubber Manufacturers Association, Inc.  
<http://www.rma.org>

SCMA      Southern Cypress Manufacturers Association  
<http://www.cypressinfo.org>

SDI      Steel Door Institute  
<http://www.steeldoor.org>

IGMA      Insulating Glass Manufacturers Alliance  
<http://www.igmaonline.org>

SJI      Steel Joist Institute  
<http://www.steeljoist.org>

SMACNA      Sheet Metal and Air-Conditioning Contractors  
National Association, Inc.  
<http://www.smacna.org>

SSPC      The Society for Protective Coatings  
<http://www.sspc.org>

STI      Steel Tank Institute  
<http://www.steeltank.com>

SWI      Steel Window Institute  
<http://www.steelwindows.com>

TCA      Tile Council of America, Inc.  
<http://www.tileusa.com>

TEMA      Tubular Exchange Manufacturers Association  
<http://www.tema.org>

TPI        Truss Plate Institute, Inc.  
          583 D'Onofrio Drive; Suite 200  
          Madison, WI 53719  
          (608) 833-5900

UBC        The Uniform Building Code  
          See ICBO

UL         Underwriters' Laboratories Incorporated  
          <http://www.ul.com>

ULC        Underwriters' Laboratories of Canada  
          <http://www.ulc.ca>

WCLIB     West Coast Lumber Inspection Bureau  
          6980 SW Varns Road, P.O. Box 23145  
          Portland, OR 97223  
          (503) 639-0651

WRCLA     Western Red Cedar Lumber Association  
          P.O. Box 120786  
          New Brighton, MN 55112  
          (612) 633-4334

WWPA     Western Wood Products Association  
          <http://www.wwpa.org>

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**SECTION 01 45 29**  
**TESTING LABORATORY SERVICES**

**PART 1 - GENERAL**

**1.1 DESCRIPTION:**

This section specifies materials testing activities and inspection services required during project construction to be provided by a Testing Laboratory retained by Department of Veterans.

**1.2 APPLICABLE PUBLICATIONS:**

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.
- B. American Association of State Highway and Transportation Officials (AASHTO):
- T27-11 .....Standard Method of Test for Sieve Analysis of Fine and Coarse Aggregates
- T96-02 (R2006) .....Standard Method of Test for Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine
- T99-10 .....Standard Method of Test for Moisture-Density Relations of Soils Using a 2.5 Kg (5.5 lb.) Rammer and a 305 mm (12 in.) Drop
- T104-99 (R2007) .....Standard Method of Test for Soundness of Aggregate by Use of Sodium Sulfate or Magnesium Sulfate
- T180-10 .....Standard Method of Test for Moisture-Density Relations of Soils using a 4.54 kg (10 lb.) Rammer and a 457 mm (18 in.) Drop
- T191-02(R2006) .....Standard Method of Test for Density of Soil In-Place by the Sand-Cone Method
- C. American Concrete Institute (ACI):
- 506.4R-94 (R2004) .....Guide for the Evaluation of Shotcrete
- D. American Society for Testing and Materials (ASTM):
- A325-10 .....Standard Specification for Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength
- A370-12 .....Standard Test Methods and Definitions for Mechanical Testing of Steel Products
- A416/A416M-10 .....Standard Specification for Steel Strand, Uncoated Seven-Wire for Prestressed Concrete

A490-12 .....Standard Specification for Heat Treated Steel  
Structural Bolts, 150 ksi Minimum Tensile  
Strength

C31/C31M-10 .....Standard Practice for Making and Curing Concrete  
Test Specimens in the Field

C33/C33M-11a .....Standard Specification for Concrete Aggregates

C39/C39M-12 .....Standard Test Method for Compressive Strength of  
Cylindrical Concrete Specimens

C109/C109M-11b .....Standard Test Method for Compressive Strength of  
Hydraulic Cement Mortars

C136-06 .....Standard Test Method for Sieve Analysis of Fine  
and Coarse Aggregates

C138/C138M-10b .....Standard Test Method for Density (Unit Weight),  
Yield, and Air Content (Gravimetric) of Concrete

C140-12 .....Standard Test Methods for Sampling and Testing  
Concrete Masonry Units and Related Units

C143/C143M-10a .....Standard Test Method for Slump of Hydraulic  
Cement Concrete

C172/C172M-10 .....Standard Practice for Sampling Freshly Mixed  
Concrete

C173/C173M-10b .....Standard Test Method for Air Content of freshly  
Mixed Concrete by the Volumetric Method

C330/C330M-09 .....Standard Specification for Lightweight  
Aggregates for Structural Concrete

C567/C567M-11 .....Standard Test Method for Density Structural  
Lightweight Concrete

C780-11 .....Standard Test Method for Pre-construction and  
Construction Evaluation of Mortars for Plain and  
Reinforced Unit Masonry

C1019-11 .....Standard Test Method for Sampling and Testing  
Grout

C1064/C1064M-11 .....Standard Test Method for Temperature of Freshly  
Mixed Portland Cement Concrete

C1077-11c .....Standard Practice for Agencies Testing Concrete  
and Concrete Aggregates for Use in Construction  
and Criteria for Testing Agency Evaluation

C1314-11a .....Standard Test Method for Compressive Strength of  
Masonry Prisms

D422-63(2007) .....Standard Test Method for Particle-Size Analysis  
of Soils

D698-07e1 .....Standard Test Methods for Laboratory Compaction  
Characteristics of Soil Using Standard Effort

D1140-00(2006) .....Standard Test Methods for Amount of Material in  
Soils Finer than No. 200 Sieve

D1143/D1143M-07e1 .....Standard Test Methods for Deep Foundations Under  
Static Axial Compressive Load

D1188-07e1 .....Standard Test Method for Bulk Specific Gravity  
and Density of Compacted Bituminous Mixtures  
Using Coated Samples

D1556-07 .....Standard Test Method for Density and Unit Weight  
of Soil in Place by the Sand-Cone Method

D1557-09 .....Standard Test Methods for Laboratory Compaction  
Characteristics of Soil Using Modified Effort  
(56,000ft lbf/ft<sup>3</sup> (2,700 KNm/m<sup>3</sup>))

D2166-06 .....Standard Test Method for Unconfined Compressive  
Strength of Cohesive Soil

D2167-08) .....Standard Test Method for Density and Unit Weight  
of Soil in Place by the Rubber Balloon Method

D2216-10 .....Standard Test Methods for Laboratory  
Determination of Water (Moisture) Content of  
Soil and Rock by Mass

D2974-07a .....Standard Test Methods for Moisture, Ash, and  
Organic Matter of Peat and Other Organic Soils

D3666-11 .....Standard Specification for Minimum Requirements  
for Agencies Testing and Inspecting Road and  
Paving Materials

D3740-11 .....Standard Practice for Minimum Requirements for  
Agencies Engaged in Testing and/or Inspection  
of Soil and Rock as used in Engineering Design  
and Construction

D6938-10 .....Standard Test Method for In-Place Density and  
Water Content of Soil and Soil-Aggregate by  
Nuclear Methods (Shallow Depth)

E94-04(2010) .....Standard Guide for Radiographic Examination

E164-08 .....Standard Practice for Contact Ultrasonic Testing  
of Weldments

E329-11c .....Standard Specification for Agencies Engaged in  
Construction Inspection, Testing, or Special  
Inspection

E543-09 .....Standard Specification for Agencies Performing  
Non-Destructive Testing

E605-93(R2011) .....Standard Test Methods for Thickness and Density  
of Sprayed Fire Resistive Material (SFRM)  
Applied to Structural Members

E709-08 .....Standard Guide for Magnetic Particle Examination

E1155-96(R2008) .....Determining FF Floor Flatness and FL Floor  
Levelness Numbers

E. American Welding Society (AWS):

D1.D1.1M-10 .....Structural Welding Code-Steel

### **1.3 REQUIREMENTS:**

- A. Accreditation Requirements: Construction materials testing laboratories must be accredited by a laboratory accreditation authority and will be required to submit a copy of the Certificate of Accreditation and Scope of Accreditation. The laboratory's scope of accreditation must include the appropriate ASTM standards (i.e.; E329, C1077, D3666, D3740, A880, E543) listed in the technical sections of the specifications. Laboratories engaged in Hazardous Materials Testing shall meet the requirements of OSHA and EPA. The policy applies to the specific laboratory performing the actual testing, not just the "Corporate Office."
- B. Inspection and Testing: Testing laboratory shall inspect materials and workmanship and perform tests described herein and additional tests requested by Resident Engineer. When it appears materials furnished, or work performed by Contractor fail to meet construction contract requirements, Testing Laboratory shall direct attention of Resident Engineer to such failure.
- C. Written Reports: Testing laboratory shall submit test reports to Resident Engineer, Contractor, unless other arrangements are agreed to in writing by the Resident Engineer. Submit reports of tests that fail to meet construction contract requirements on colored paper.
- D. Verbal Reports: Give verbal notification to Resident Engineer immediately of any irregularity.

### **PART 2 - PRODUCTS (NOT USED)**

### **PART 3 - EXECUTION**

#### **3.1 CONCRETE:**

- A. Batch Plant Inspection and Materials Testing:
1. Perform continuous batch plant inspection until concrete quality is established to satisfaction of Resident Engineer with concurrence of Contracting Officer and perform periodic inspections thereafter as determined by Resident Engineer.



2. Periodically inspect and test batch proportioning equipment for accuracy and report deficiencies to Resident Engineer.
3. Sample and test mix ingredients as necessary to insure compliance with specifications.
4. Sample and test aggregates daily and as necessary for moisture content. Test the dry rodded weight of the coarse aggregate whenever a sieve analysis is made, and when it appears there has been a change in the aggregate.
5. Certify, in duplicate, ingredients and proportions and amounts of ingredients in concrete conform to approved trial mixes. When concrete is batched or mixed off immediate building site, certify (by signing, initialing or stamping thereon) on delivery slips (duplicate) that ingredients in truck-load mixes conform to proportions of aggregate weight, cement factor, and water-cement ratio of approved trial mixes.

B. Field Inspection and Materials Testing:

1. Provide a technician at site of placement at all times to perform concrete sampling and testing.
2. Review the delivery tickets of the ready-mix concrete trucks arriving on-site. Notify the Contractor if the concrete cannot be placed within the specified time limits or if the type of concrete delivered is incorrect. Reject any loads that do not comply with the Specification requirements. Rejected loads are to be removed from the site at the Contractor's expense. Any rejected concrete that is placed will be subject to removal.
3. If slump or air content fall outside specified limits, make another test immediately from another portion of same batch.
4. Perform unit weight tests in compliance with ASTM C138 for normal weight concrete and ASTM C567 for lightweight concrete. Test the first truck and each time cylinders are made.
5. Notify laboratory technician at batch plant of mix irregularities and request materials and proportioning check.
6. Verify that specified mixing has been accomplished.
7. Inspect the reinforcing steel placement, including bar size, bar spacing, top and bottom concrete cover, proper tie into the chairs, and grade of steel prior to concrete placement. Submit detailed report of observations.
8. Observe conveying, placement, and consolidation of concrete for conformance to specifications.
9. Observe condition of formed surfaces upon removal of formwork prior to repair of surface defects and observe repair of surface defects.

10. Observe curing procedures for conformance with specifications, record dates of concrete placement, start of preliminary curing, start of final curing, end of curing period.
  11. Observe preparations for placement of concrete:
    - a. Inspect handling, conveying, and placing equipment, inspect vibrating and compaction equipment.
    - b. Inspect preparation of construction, expansion, and isolation joints.
  12. Observe preparations for protection from hot weather, cold weather, sun, and rain, and preparations for curing.
  13. Observe concrete mixing:
    - a. Monitor and record amount of water added at project site.
    - b. Observe minimum and maximum mixing times.
  14. Measure concrete flatwork for levelness and flatness as follows:
    - a. Perform Floor Tolerance Measurements  $F_F$  and  $F_L$  in accordance with ASTM E1155. Calculate the actual overall F- numbers using the inferior/superior area method.
    - b. Perform all floor tolerance measurements within 48 hours after slab installation and prior to removal of shoring and formwork.
    - c. Provide the Contractor and the Resident Engineer with the results of all profile tests, including a running tabulation of the overall  $F_F$  and  $F_L$  values for all slabs installed to date, within 72 hours after each slab installation.
  15. Other inspections:
    - a. Grouting under base plates.
    - b. Grouting anchor bolts and reinforcing steel in hardened concrete.
- C. Laboratory Tests of Field Samples:
1. Test compression test cylinders for strength in accordance with ASTM C39. For each test series, test one cylinder at 7 days and one cylinder at 28 days. Use remaining cylinder as a spare tested as directed by Resident Engineer. Compile laboratory test reports as follows: Compressive strength test shall be result of one cylinder, except when one cylinder shows evidence of improper sampling, molding or testing, in which case it shall be discarded and strength of spare cylinder shall be used.
  2. Make weight tests of hardened lightweight structural concrete in accordance with ASTM C567.
  3. Furnish certified compression test reports (duplicate) to Resident Engineer. In test report, indicate the following information:
    - a. Cylinder identification number and date cast.
    - b. Specific location at which test samples were taken.

- c. Type of concrete, slump, and percent air.
- d. Compressive strength of concrete in MPa (psi).
- e. Weight of lightweight structural concrete in kg/m<sup>3</sup> (pounds per cubic feet).
- f. Weather conditions during placing.
- g. Temperature of concrete in each test cylinder when test cylinder was molded.
- h. Maximum and minimum ambient temperature during placing.
- i. Ambient temperature when concrete sample in test cylinder was taken.
- j. Date delivered to laboratory and date tested.

### **3.2 REINFORCEMENT:**

- A. Review mill test reports furnished by Contractor.
- B. Make one tensile and one bend test in accordance with ASTM A370 from each pair of samples obtained.
- C. Written report shall include, in addition to test results, heat number, manufacturer, type and grade of steel, and bar size.
- D. Perform tension tests of mechanical and welded splices in accordance with ASTM A370.

### **3.3 SHOTCRETE:**

- A. Inspection and Material Testing:
  - 1. Provide field inspection and testing service as required by Resident Engineer to certify that shotcrete has been applied in accordance with contract documents.
  - 2. Periodically inspect and test proportioning equipment for accuracy and report deficiencies to Resident Engineer.
  - 3. Sample and test mix ingredients as necessary to insure compliance with specifications.
  - 4. Sample and test aggregates daily and as necessary for moisture content. Report instances of excessive moisture to Resident Engineer.
  - 5. Certify, in duplicate, that ingredients and proportions and amounts of ingredients in shotcrete conform to approved trial mixes.
  - 6. Provide field inspection of the proper size and placement of the reinforcement in the shotcrete.
- B. Shotcrete Sampling:
  - 1. Provide a technician at site of placement to perform shotcrete sampling.
  - 2. Take cores in accordance with ACI 506.
  - 3. Insure maintenance of water-cement ratio established by approved trial mix.

4. Verify specified mixing has been accomplished.

C. Laboratory Tests of Field Sample Panels:

1. Compression test core for strength in accordance with ACI 506. For each test series of three cores, test one core at 7 days and one core at 28 days. Use remaining core as a spare to be tested at either 7 or 28 days as required. Compile laboratory test reports as follows:  
Compressive strength test shall be result of one core, except when one core shows evidence of improper sampling or testing, in which case it shall be discarded and strength of spare core shall be used.
2. Submit certified compression test reports (duplicate) to Resident Engineer. On test report, indicate following information:
  - a. Core identification number and date cast.
  - b. Specific location at which test samples were taken.
  - c. Compressive strength of shotcrete in MPa (psi).
  - d. Weather conditions during placing.
  - e. Temperature of shotcrete in each test core when test core was taken.
  - f. Maximum and minimum ambient temperature during placing.
  - g. Ambient temperature when shotcrete sample was taken.
  - h. Date delivered to laboratory and date tested.

- D. Submit inspection reports certification and instances of noncompliance to Resident Engineer.

**3.4 MASONRY:**

A. Mortar Tests:

1. Laboratory compressive strength test:
  - a. Comply with ASTM C780.
  - b. Obtain samples during or immediately after discharge from batch mixer.
  - c. Furnish molds with 50 mm (2 inch), 3 compartment gang cube.
  - d. Test one sample at 7 days and 2 samples at 28 days.
2. Two tests during first week of operation; one test per week after initial test until masonry completion.

B. Grout Tests:

1. Laboratory compressive strength test:
  - a. Comply with ASTM C1019.
  - b. Test one sample at 7 days and 2 samples at 28 days.
  - c. Perform test for each 230 m<sup>2</sup> (2500 square feet) of masonry.

C. Masonry Unit Tests:

1. Laboratory Compressive Strength Test:
  - a. Comply with ASTM C140.
  - b. Test 3 samples for each 460 m<sup>2</sup> (5000 square feet) of wall area.

- D. Prism Tests: For each type of wall construction indicated, test masonry prisms per ASTM C1314 for each 460 m<sup>2</sup> (5000 square feet) of wall area. Prepare one set of prisms for testing at 7 days and one set for testing at 28 days.

### 3.5 STRUCTURAL STEEL:

- A. General: Provide shop and field inspection and testing services to certify structural steel work is done in accordance with contract documents. Welding shall conform to AWS D1.1 Structural Welding Code.
- B. Prefabrication Inspection:
1. Review design and shop detail drawings for size, length, type and location of all welds to be made.
  2. Approve welding procedure qualifications either by pre-qualification or by witnessing qualifications tests.
  3. Approve welder qualifications by certification or retesting.
  4. Approve procedure for control of distortion and shrinkage stresses.
  5. Approve procedures for welding in accordance with applicable sections of AWS D1.1.
- C. Fabrication and Erection:
1. Weld Inspection:
    - a. Inspect welding equipment for capacity, maintenance and working condition.
    - b. Verify specified electrodes and handling and storage of electrodes in accordance with AWS D1.1.
    - c. Inspect preparation and assembly of materials to be welded for conformance with AWS D1.1.
    - d. Inspect preheating and interpass temperatures for conformance with AWS D1.1.
    - e. Measure 25 percent of fillet welds.
    - f. Welding Magnetic Particle Testing: Test in accordance with ASTM E709 for a minimum of:
      - 1) 20 percent of all shear plate fillet welds at random, final pass only.
      - 2) 20 percent of all continuity plate and bracing gusset plate fillet welds, at random, final pass only.
      - 3) 100 percent of tension member fillet welds (i.e., hanger connection plates and other similar connections) for root and final passes.
      - 4) 20 percent of length of built-up column member partial penetration and fillet welds at random for root and final passes.

5) 100 percent of length of built-up girder member partial penetration and fillet welds for root and final passes.

- g. Welding Ultrasonic Testing: Test in accordance with ASTM E164 and AWS D1.1 for 100 percent of all full penetration welds, braced and moment frame column splices, and a minimum of 20 percent of all other partial penetration column splices, at random.

SPEC WRITER NOTE: Specify radiographic testing only for very large jobs or those with complicated full penetration welds.

- h. Welding Radiographic Testing: Test in accordance with ASTM E94, and AWS D1.1 for 5 percent of all full penetration welds at random.
- i. Verify that correction of rejected welds are made in accordance with AWS D1.1.
- j. Testing and inspection do not relieve the Contractor of the responsibility for providing materials and fabrication procedures in compliance with the specified requirements.

2. Bolt Inspection:

- a. Inspect high-strength bolted connections in accordance AISC Specifications for Structural Joints Using ASTM A325 or A490 Bolts.
- b. Slip-Critical Connections: Inspect 10 percent of bolts, but not less than 2 bolts, selected at random in each connection in accordance with AISC Specifications for Structural Joints Using ASTM A325 or A490 Bolts. Inspect all bolts in connection when one or more are rejected.
- c. Fully Pre-tensioned Connections: Inspect 10 percent of bolts, but not less than 2 bolts, selected at random in 25 percent of connections in accordance with AISC Specification for Structural Joints Using ASTM A325 or A490 Bolts. Inspect all bolts in connection when one or more are rejected.
- d. Bolts installed by turn-of-nut tightening may be inspected with calibrated wrench when visual inspection was not performed during tightening.
- e. Snug Tight Connections: Inspect 10 percent of connections verifying that plies of connected elements have been brought into snug contact.
- f. Inspect field erected assemblies; verify locations of structural steel for plumbness, level, and alignment.

- D. Submit inspection reports, record of welders and their certification, and identification, and instances of noncompliance to Resident Engineer.

**3.6 SHEAR CONNECTOR STUDS:**

- A. Provide field inspection and testing services required by AWS D.1 to insure shear connector studs have been installed in accordance with contract documents.
- B. Tests: Test 20 percent of headed studs for fastening strength in accordance with AWS D1.1.
- C. Submit inspection reports, certification, and instances of noncompliance to Resident Engineer.

**3.7 SPRAYED-ON FIREPROOFING:**

- A. Provide field inspection and testing services to certify sprayed-on fireproofing has been applied in accordance with contract documents.
- B. Obtain a copy of approved submittals from Resident Engineer.
- C. Use approved installation in test areas as criteria for inspection of work.
- D. Test sprayed-on fireproofing for thickness and density in accordance with ASTM E605.
  - 1. Thickness gauge specified in ASTM E605 may be modified for pole extension so that overhead sprayed material can be reached from floor.
- E. Location of test areas for field tests as follows:
  - 1. Thickness: Select one bay per floor, or one bay for each 930 m<sup>2</sup> (10,000 square feet) of floor area, whichever provides for greater number of tests. Take thickness determinations from each of following locations: Metal deck, beam, and column.
  - 2. Density: Take density determinations from each floor, or one test from each 930 m<sup>2</sup> (10,000 square feet) of floor area, whichever provides for greater number of tests, from each of the following areas: Underside of metal deck, beam flanges, and beam web.
- F. Submit inspection reports, certification, and instances of noncompliance to Resident Engineer.

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**SECTION 01 57 19**  
**TEMPORARY ENVIRONMENTAL CONTROLS**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

- A. This section specifies the control of environmental pollution and damage that the Contractor must consider for air, water, and land resources. It includes management of visual aesthetics, noise, solid waste, radiant energy, and radioactive materials, as well as other pollutants and resources encountered or generated by the Contractor. The Contractor is obligated to consider specified control measures with the costs included within the various contract items of work.
- B. Environmental pollution and damage is defined as the presence of chemical, physical, or biological elements or agents which:
1. Adversely effect human health or welfare,
  2. Unfavorably alter ecological balances of importance to human life,
  3. Effect other species of importance to humankind, or;
  4. Degrade the utility of the environment for aesthetic, cultural, and historical purposes.
- C. Definitions of Pollutants:
1. Chemical Waste: Petroleum products, bituminous materials, salts, acids, alkalis, herbicides, pesticides, organic chemicals, and inorganic wastes.
  2. Debris: Combustible and noncombustible wastes, such as leaves, tree trimmings, ashes, and waste materials resulting from construction or maintenance and repair work.
  3. Sediment: Soil and other debris that has been eroded and transported by runoff water.
  4. Solid Waste: Rubbish, debris, garbage, and other discarded solid materials resulting from industrial, commercial, and agricultural operations and from community activities.
  5. Surface Discharge: The term "Surface Discharge" implies that the water is discharged with possible sheeting action and subsequent soil erosion may occur. Waters that are surface discharged may terminate in drainage ditches, storm sewers, creeks, and/or "water of the United States" and would require a permit to discharge water from the governing agency.
  6. Rubbish: Combustible and noncombustible wastes such as paper, boxes, glass and crockery, metal and lumber scrap, tin cans, and bones.



7. Sanitary Wastes:

- a. Sewage: Domestic sanitary sewage and human and animal waste.
- b. Garbage: Refuse and scraps resulting from preparation, cooking, dispensing, and consumption of food.

**1.2 QUALITY CONTROL**

- A. Establish and maintain quality control for the environmental protection of all items set forth herein.
- B. Record on daily reports any problems in complying with laws, regulations, and ordinances. Note any corrective action taken.

**1.3 REFERENCES**

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.
- B. U.S. National Archives and Records Administration (NARA):  
33 CFR 328 .....Definitions

**1.4 SUBMITTALS**

- A. In accordance with Section, 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES, furnish the following:
  - 1. Environmental Protection Plan: After the contract is awarded and prior to the commencement of the work, the Contractor shall meet with the Resident Engineer to discuss the proposed Environmental Protection Plan and to develop mutual understanding relative to details of environmental protection. Not more than 20 days after the meeting, the Contractor shall prepare and submit to the Resident Engineer for approval, a written and/or graphic Environmental Protection Plan including, but not limited to, the following:
    - a. Name(s) of person(s) within the Contractor's organization who is (are) responsible for ensuring adherence to the Environmental Protection Plan.
    - b. Name(s) and qualifications of person(s) responsible for manifesting hazardous waste to be removed from the site.
    - c. Name(s) and qualifications of person(s) responsible for training the Contractor's environmental protection personnel.
    - d. Description of the Contractor's environmental protection personnel training program.
    - e. A list of Federal, State, and local laws, regulations, and permits concerning environmental protection, pollution control, noise control and abatement that are applicable to the Contractor's proposed operations and the requirements imposed by those laws, regulations, and permits.

- f. Methods for protection of features to be preserved within authorized work areas including trees, shrubs, vines, grasses, ground cover, landscape features, air and water quality, fish and wildlife, soil, historical, and archeological and cultural resources.
  - g. Procedures to provide the environmental protection that comply with the applicable laws and regulations. Describe the procedures to correct pollution of the environment due to accident, natural causes, or failure to follow the procedures as described in the Environmental Protection Plan.
  - h. Permits, licenses, and the location of the solid waste disposal area.
  - i. Drawings showing locations of any proposed temporary excavations or embankments for haul roads, // stream crossings, // material storage areas, structures, sanitary facilities, and stockpiles of excess or spoil materials. Include as part of an Erosion Control Plan approved by the District Office of the U.S. Soil Conservation Service and the Department of Veterans Affairs.
  - j. Environmental Monitoring Plans for the job site including land, water, air, and noise.
  - k. Work Area Plan showing the proposed activity in each portion of the area and identifying the areas of limited use or nonuse. Plan should include measures for marking the limits of use areas. This plan may be incorporated within the Erosion Control Plan.
- B. Approval of the Contractor's Environmental Protection Plan will not relieve the Contractor of responsibility for adequate and continued control of pollutants and other environmental protection measures.

#### **1.5 PROTECTION OF ENVIRONMENTAL RESOURCES**

- A. Protect environmental resources within the project boundaries and those affected outside the limits of permanent work during the entire period of this contract. Confine activities to areas defined by the specifications and drawings.
- B. Protection of Land Resources: Prior to construction, identify all land resources to be preserved within the work area. Do not remove, cut, deface, injure, or destroy land resources including trees, shrubs, vines, grasses, top soil, and land forms without permission from the Resident Engineer. Do not fasten or attach ropes, cables, or guys to trees for anchorage unless specifically authorized, or where special emergency use is permitted.
  - 1. Work Area Limits: Prior to any construction, mark the areas that require work to be performed under this contract. Mark or fence

- isolated areas within the general work area that are to be saved and protected. Protect monuments, works of art, and markers before construction operations begin. Convey to all personnel the purpose of marking and protecting all necessary objects.
2. Protection of Landscape: Protect trees, shrubs, vines, grasses, land forms, and other landscape features shown on the drawings to be preserved by marking, fencing, or using any other approved techniques.
    - a. Box and protect from damage existing trees and shrubs to remain on the construction site.
    - b. Immediately repair all damage to existing trees and shrubs by trimming, cleaning, and painting with antiseptic tree paint.
    - c. Do not store building materials or perform construction activities closer to existing trees or shrubs than the farthest extension of their limbs.
  3. Reduction of Exposure of Unprotected Erodible Soils: Plan and conduct earthwork to minimize the duration of exposure of unprotected soils. Clear areas in reasonably sized increments only as needed to use. Form earthwork to final grade as shown. Immediately protect side slopes and back slopes upon completion of rough grading.
  4. Temporary Protection of Disturbed Areas: Construct diversion ditches, benches, and berms to retard and divert runoff from the construction site to protected drainage areas approved under paragraph 208 of the Clean Water Act.
  5. Protect adjacent areas from despoilment by temporary excavations and embankments.
  6. Handle and dispose of solid wastes in such a manner that will prevent contamination of the environment. Place solid wastes (excluding clearing debris) in containers that are emptied on a regular schedule. Transport all solid waste off Government property and dispose of waste in compliance with Federal, State, and local requirements.
  7. Store chemical waste away from the work areas in corrosion resistant containers and dispose of waste in accordance with Federal, State, and local regulations.
  8. Handle discarded materials other than those included in the solid waste category as directed by the Resident Engineer.
- C. Protection of Air Resources: Keep construction activities under surveillance, management, and control to minimize pollution of air resources. Burning is not permitted on the job site. Keep activities, equipment, processes, and work operated or performed, in strict

accordance with the State of New York and Federal emission and performance laws and standards. Maintain ambient air quality standards set by the Environmental Protection Agency, for those construction operations and activities specified.

1. Particulates: Control dust particles, aerosols, and gaseous by-products from all construction activities, processing, and preparation of materials (such as from asphaltic batch plants) at all times, including weekends, holidays, and hours when work is not in progress.
  2. Particulates Control: Maintain all excavations, stockpiles, haul roads, permanent and temporary access roads, plant sites, spoil areas, borrow areas, and all other work areas within or outside the project boundaries free from particulates which would cause a hazard or a nuisance. Sprinklering, chemical treatment of an approved type, light bituminous treatment, baghouse, scrubbers, electrostatic precipitators, or other methods are permitted to control particulates in the work area.
  3. Hydrocarbons and Carbon Monoxide: Control monoxide emissions from equipment to Federal and State allowable limits.
  4. Odors: Control odors of construction activities and prevent obnoxious odors from occurring.
- D. Reduction of Noise: Minimize noise using every action possible. Perform noise-producing work in less sensitive hours of the day or week as directed by the Resident Engineer. Maintain noise-produced work at or below the decibel levels and within the time periods specified by the Resident Engineer.
- G. Restoration of Damaged Property: If any direct or indirect damage is done to public or private property resulting from any act, omission, neglect, or misconduct, the Contractor shall restore the damaged property to a condition equal to that existing before the damage at no additional cost to the Government. Repair, rebuild, or restore property as directed or make good such damage in an acceptable manner.
- H. Final Clean-up: On completion of project and after removal of all debris, rubbish, and temporary construction, Contractor shall leave the construction area in a clean condition satisfactory to the Resident Engineer. Cleaning shall include off the station disposal of all items and materials not required to be salvaged, as well as all debris and rubbish resulting from demolition and new work operations.

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**SECTION 01 58 16**  
**TEMPORARY INTERIOR SIGNAGE**

**PART 1 GENERAL****DESCRIPTION**

This section specifies temporary interior signs.

**PART 2 PRODUCTS****2.1 TEMPORARY SIGNS**

- A. Fabricate from 50 Kg (110 pound) mat finish white paper.
- B. Cut to 100 mm (4-inch) wide by 300 mm (12 inch) long size tag.
- C. Punch 3 mm (1/8-inch) diameter hole centered on 100 mm (4-inch) dimension of tag. Edge of Hole spaced approximately 13 mm (1/2-inch) from one end on tag.
- D. Reinforce hole on both sides with gummed cloth washer or other suitable material capable of preventing tie pulling through paper edge.
- E. Ties: Steel wire 0.3 mm (0.0120-inch) thick, attach to tag with twist tie, leaving 150 mm (6-inch) long free ends.

**PART 3 EXECUTION****3.1 INSTALLATION**

- A. Install temporary signs attached to room door frame or room door knob, lever, or pull for doors on corridor openings.
- B. Mark on signs with felt tip marker having approximately 3 mm (1/8-inch) wide stroke for clearly legible numbers or letters.
- C. Identify room with numbers as designated on floor plans.

**3.2 LOCATION**

- A. Install on doors that have room, corridor, and space numbers shown.
- B. Doors that do not require signs are as follows:
  - 1. Corridor barrier doors (cross-corridor) in corridor with same number.
  - 2. Folding doors or partitions.
  - 3. Toilet or bathroom doors within and between rooms.
  - 4. Communicating doors in partitions between rooms with corridor entrance doors.
  - 5. Closet doors within rooms.
- C. Replace missing, damaged, or illegible signs.

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**SECTION 01 74 19**  
**CONSTRUCTION WASTE MANAGEMENT**

**PART 1 - GENERAL****1.1 DESCRIPTION**

- A. This section specifies the requirements for the management of non-hazardous building construction and demolition waste.
- B. Waste disposal in landfills shall be minimized to the greatest extent possible. Of the inevitable waste that is generated, as much of the waste material as economically feasible shall be salvaged, recycled or reused.
- C. Contractor shall use all reasonable means to divert construction and demolition waste from landfills and incinerators, and facilitate their salvage and recycle not limited to the following:
  - 1. Waste Management Plan development and implementation.
  - 2. Techniques to minimize waste generation.
  - 3. Sorting and separating of waste materials.
  - 4. Salvage of existing materials and items for reuse or resale.
  - 5. Recycling of materials that cannot be reused or sold.
- D. At a minimum the following waste categories shall be diverted from landfills:
  - 1. Soil.
  - 2. Inerts (eg, concrete, masonry and asphalt).
  - 3. Clean dimensional wood and palette wood.
  - 4. Green waste (biodegradable landscaping materials).
  - 5. Engineered wood products (plywood, particle board and I-joists, etc).
  - 6. Metal products (eg, steel, wire, beverage containers, copper, etc).
  - 7. Cardboard, paper and packaging.
  - 8. Bitumen roofing materials.
  - 9. Plastics (eg, ABS, PVC).
  - 10. Carpet and/or pad.
  - 11. Gypsum board.
  - 12. Insulation.
  - 13. Paint.
  - 14. Fluorescent lamps.

**1.2 RELATED WORK**

- A. Section 02 41 00, DEMOLITION.
- B. Section 01 00 00, GENERAL REQUIREMENTS.

C. Lead Paint: Section 02 83 33.13, LEAD BASED PAINT REMOVAL AND DISPOSAL.

### **1.3 QUALITY ASSURANCE**

- A. Contractor shall practice efficient waste management when sizing, cutting and installing building products. Processes shall be employed to ensure the generation of as little waste as possible. Construction Demolition waste includes products of the following:
1. Excess or unusable construction materials.
  2. Packaging used for construction products.
  3. Poor planning and/or layout.
  4. Construction error.
  5. Over ordering.
  6. Weather damage.
  7. Contamination.
  8. Mishandling.
  9. Breakage.
- B. Establish and maintain the management of non-hazardous building construction and demolition waste set forth herein. Conduct a site assessment to estimate the types of materials that will be generated by demolition and construction.
- C. Contractor shall develop and implement procedures to recycle construction and demolition waste to a minimum of 50 percent.
- D. Contractor shall be responsible for implementation of any special programs involving rebates or similar incentives related to recycling. Any revenues or savings obtained from salvage or recycling shall accrue to the contractor.
- E. Contractor shall provide all demolition, removal and legal disposal of materials. Contractor shall ensure that facilities used for recycling, reuse and disposal shall be permitted for the intended use to the extent required by local, state, federal regulations. The Whole Building Design Guide website <http://www.cwm.wbdg.org> provides a Construction Waste Management Database that contains information on companies that haul, collect, and process recyclable debris from construction projects.
- F. Contractor shall assign a specific area to facilitate separation of materials for reuse, salvage, recycling, and return. Such areas are to be kept neat and clean and clearly marked in order to avoid contamination or mixing of materials.



- G. Contractor shall provide on-site instructions and supervision of separation, handling, salvaging, recycling, reuse and return methods to be used by all parties during waste generating stages.
- H. Record on daily reports any problems in complying with laws, regulations and ordinances with corrective action taken.

#### **1.4 TERMINOLOGY**

- A. Class III Landfill: A landfill that accepts non-hazardous resources such as household, commercial and industrial waste resulting from construction, remodeling, repair and demolition operations.
- B. Clean: Untreated and unpainted; uncontaminated with adhesives, oils, solvents, mastics and like products.
- C. Construction and Demolition Waste: Includes all non-hazardous resources resulting from construction, remodeling, alterations, repair and demolition operations.
- D. Dismantle: The process of parting out a building in such a way as to preserve the usefulness of its materials and components.
- E. Disposal: Acceptance of solid wastes at a legally operating facility for the purpose of land filling (includes Class III landfills and inert fills).
- F. Inert Backfill Site: A location, other than inert fill or other disposal facility, to which inert materials are taken for the purpose of filling an excavation, shoring or other soil engineering operation.
- G. Inert Fill: A facility that can legally accept inert waste, such as asphalt and concrete exclusively for the purpose of disposal.
- H. Inert Solids/Inert Waste: Non-liquid solid resources including, but not limited to, soil and concrete that does not contain hazardous waste or soluble pollutants at concentrations in excess of water-quality objectives established by a regional water board, and does not contain significant quantities of decomposable solid resources.
- I. Mixed Debris: Loads that include commingled recyclable and non-recyclable materials generated at the construction site.
- J. Mixed Debris Recycling Facility: A solid resource processing facility that accepts loads of mixed construction and demolition debris for the purpose of recovering re-usable and recyclable materials and disposing non-recyclable materials.
- K. Permitted Waste Hauler: A company that holds a valid permit to collect and transport solid wastes from individuals or businesses for the purpose of recycling or disposal.

- L. Recycling: The process of sorting, cleansing, treating, and reconstituting materials for the purpose of using the altered form in the manufacture of a new product. Recycling does not include burning, incinerating or thermally destroying solid waste.
1. On-site Recycling - Materials that are sorted and processed on site for use in an altered state in the work, i.e. concrete crushed for use as a sub-base in paving.
  2. Off-site Recycling - Materials hauled to a location and used in an altered form in the manufacture of new products.
- M. Recycling Facility: An operation that can legally accept materials for the purpose of processing the materials into an altered form for the manufacture of new products. Depending on the types of materials accepted and operating procedures, a recycling facility may or may not be required to have a solid waste facilities permit or be regulated by the local enforcement agency.
- N. Reuse: Materials that are recovered for use in the same form, on-site or off-site.
- O. Return: To give back reusable items or unused products to vendors for credit.
- P. Salvage: To remove waste materials from the site for resale or re-use by a third party.
- Q. Source-Separated Materials: Materials that are sorted by type at the site for the purpose of reuse and recycling.
- R. Solid Waste: Materials that have been designated as non-recyclable and are discarded for the purposes of disposal.
- S. Transfer Station: A facility that can legally accept solid waste for the purpose of temporarily storing the materials for re-loading onto other trucks and transporting them to a landfill for disposal, or recovering some materials for re-use or recycling.

#### **1.5 SUBMITTALS**

- A. In accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, and SAMPLES, furnish the following:
- B. Prepare and submit to the Resident Engineer a written demolition debris management plan. The plan shall include, but not be limited to, the following information:
1. Procedures to be used for debris management.
  2. Techniques to be used to minimize waste generation.
  3. Analysis of the estimated job site waste to be generated:

- a. List of each material and quantity to be salvaged, reused, recycled.
- b. List of each material and quantity proposed to be taken to a landfill.
4. Detailed description of the Means/Methods to be used for material handling.
  - a. On site: Material separation, storage, protection where applicable.
  - b. Off site: Transportation means and destination. Include list of materials.
    - 1) Description of materials to be site-separated and self-hauled to designated facilities.
    - 2) Description of mixed materials to be collected by designated waste haulers and removed from the site.
  - c. The names and locations of mixed debris reuse and recycling facilities or sites.
  - d. The names and locations of trash disposal landfill facilities or sites.
  - e. Documentation that the facilities or sites are approved to receive the materials.
- C. Designated Manager responsible for instructing personnel, supervising, documenting and administer over meetings relevant to the Waste Management Plan.
- D. Monthly summary of construction and demolition debris diversion and disposal, quantifying all materials generated at the work site and disposed of or diverted from disposal through recycling.

#### **1.6 APPLICABLE PUBLICATIONS**

- A Publications listed below form a part of this specification to the extent referenced. Publications are referenced by the basic designation only. In the event that criteria requirements conflict, the most stringent requirements shall be met.
- B. U.S. Green Building Council (USGBC):  
LEED Green Building Rating System for New Construction

#### **1.7 RECORDS**

Maintain records to document the quantity of waste generated; the quantity of waste diverted through sale, reuse, or recycling; and the quantity of waste disposed by landfill or incineration. Records shall be kept in accordance with the LEED Reference Guide and LEED Template.

**PART 2 - PRODUCTS****2.1 MATERIALS**

- A. List of each material and quantity to be salvaged, recycled, reused.
- B. List of each material and quantity proposed to be taken to a landfill.
- C. Material tracking data: Receiving parties, dates removed, transportation costs, weight tickets, tipping fees, manifests, invoices, net total costs or savings.

**PART 3 - EXECUTION****3.1 COLLECTION**

- A. Provide all necessary containers, bins and storage areas to facilitate effective waste management.
- B. Clearly identify containers, bins and storage areas so that recyclable materials are separated from trash and can be transported to respective recycling facility for processing.
- C. Hazardous wastes shall be separated, stored, disposed of according to local, state, federal regulations.

**3.2 DISPOSAL**

- A. Contractor shall be responsible for transporting and disposing of materials that cannot be delivered to a source-separated or mixed materials recycling facility to a transfer station or disposal facility that can accept the materials in accordance with state and federal regulations.
- B. Construction or demolition materials with no practical reuse or that cannot be salvaged or recycled shall be disposed of at a landfill or incinerator.

**3.3 REPORT**

- A. With each application for progress payment, submit a summary of construction and demolition debris diversion and disposal including beginning and ending dates of period covered.
- B. Quantify all materials diverted from landfill disposal through salvage or recycling during the period with the receiving parties, dates removed, transportation costs, weight tickets, manifests, invoices. Include the net total costs or savings for each salvaged or recycled material.

C. Quantify all materials disposed of during the period with the receiving parties, dates removed, transportation costs, weight tickets, tipping fees, manifests, invoices. Include the net total costs for each disposal.

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**SECTION 01 91 00****GENERAL COMMISSIONING REQUIREMENTS****PART 1 - GENERAL****1.1 COMMISSIONING DESCRIPTION**

- A. This Section 01 91 00 GENERAL COMMISSIONING REQUIREMENTS shall form the basis of the construction phase commissioning process and procedures. The Commissioning Agent shall add, modify, and refine the commissioning procedures, as approved by the Department of Veterans Affairs (VA), to suit field conditions and actual manufacturer's equipment, incorporate test data and procedure results, and provide detailed scheduling for all commissioning tasks.
- B. Various sections of the project specifications require equipment startup, testing, and adjusting services. Requirements for startup, testing, and adjusting services specified in the Division 7, Division 21, Division 22, Division 23, Division 26, Division 27, Division 28, and Division 31 series sections of these specifications are intended to be provided in coordination with the commissioning services and are not intended to duplicate services. The Contractor shall coordinate the work required by individual specification sections with the commissioning services requirements specified herein.
- C. Where individual testing, adjusting, or related services are required in the project specifications and not specifically required by this commissioning requirements specification, the specified services shall be provided and copies of documentation, as required by those specifications shall be submitted to the VA and the Commissioning Agent to be indexed for future reference.
- D. Where training or educational services for VA are required and specified in other sections of the specifications, including but not limited to Division 7, Division 8, Division 21, Division 22, Division 23, Division 26, Division 27, Division 28, and Division 31 series sections of the specification, these services are intended to be provided in addition to the training and educational services specified herein.
- E. Commissioning is a systematic process of verifying that the building systems perform interactively according to the construction documents and the VA's operational needs. The commissioning process shall encompass and coordinate the system documentation, equipment startup,

control system calibration, testing and balancing, performance testing and training. Commissioning during the construction and post-occupancy phases is intended to achieve the following specific objectives according to the contract documents:

1. Verify that the applicable equipment and systems are installed in accordance with the contract documents and according to the manufacturer's recommendations.
  2. Verify and document proper integrated performance of equipment and systems.
  3. Verify that Operations & Maintenance documentation is complete.
  4. Verify that all components requiring servicing can be accessed, serviced and removed without disturbing nearby components including ducts, piping, cabling or wiring.
  5. Verify that the VA's operating personnel are adequately trained to enable them to operate, monitor, adjust, maintain, and repair building systems in an effective and energy-efficient manner.
  6. Document the successful achievement of the commissioning objectives listed above.
- F. The commissioning process does not take away from or reduce the responsibility of the Contractor to provide a finished and fully functioning product.

## **1.2 CONTRACTUAL RELATIONSHIPS**

- A. For this construction project, the Department of Veterans Affairs contracts with a Contractor to provide construction services. The contracts are administered by the VA Contracting Officer and the Resident Engineer as the designated representative of the Contracting Officer. On this project, the authority to modify the contract in any way is strictly limited to the authority of the Contracting Officer.
- B. In this project, only two contract parties are recognized and communications on contractual issues are strictly limited to VA Resident Engineer and the Contractor. It is the practice of the VA to require that communications between other parties to the contracts (Subcontractors and Vendors) be conducted through the Resident Engineer and Contractor. It is also the practice of the VA that communications between other parties of the project (Commissioning Agent and Architect/Engineer) be conducted through the Resident Engineer.
- C. Whole Building Commissioning is a process that relies upon frequent and direct communications, as well as collaboration between all parties to



the construction process. By its nature, a high level of communication and cooperation between the Commissioning Agent and all other parties (Architects, Engineers, Subcontractors, Vendors, third party testing agencies, etc.) is essential to the success of the Commissioning effort.

D. With these fundamental practices in mind, the commissioning process described herein has been developed to recognize that, in the execution of the Commissioning Process, the Commissioning Agent must develop effective methods to communicate with every member of the construction team involved in delivering commissioned systems while simultaneously respecting the exclusive contract authority of the Contracting Officer and Resident Engineer. Thus, the procedures outlined in this specification must be executed within the following limitations:

1. No communications (verbal or written) from the Commissioning Agent shall be deemed to constitute direction that modifies the terms of any contract between the Department of Veterans Affairs and the Contractor.
2. Commissioning Issues identified by the Commissioning Agent will be delivered to the Resident Engineer and copied to the designated Commissioning Representatives for the Contractor and subcontractors on the Commissioning Team for information only in order to expedite the communication process. These issues must be understood as the professional opinion of the Commissioning Agent and as suggestions for resolution.
3. In the event that any Commissioning Issues and suggested resolutions are deemed by the Resident Engineer to require either an official interpretation of the construction documents or require a modification of the contract documents, the Contracting Officer or Resident Engineer will issue an official directive to this effect.
4. All parties to the Commissioning Process shall be individually responsible for alerting the Resident Engineer of any issues that they deem to constitute a potential contract change prior to acting on these issues.
5. Authority for resolution or modification of design and construction issues rests solely with the Contracting Officer or Resident Engineer, with appropriate technical guidance from the Architect/Engineer and/or Commissioning Agent.

### 1.3 RELATED WORK

- A. Section 01 00 00 GENERAL REQUIREMENTS.
- B. Section 01 32.16.16 NETWORK ANALYSIS SCHEDULES (SMALL PROJECTS - DESIGN/BID/BUILD)
- C. Section 01 33 23 SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES

### 1.4 SUMMARY

- A. This Section includes general requirements that apply to implementation of commissioning without regard to systems, subsystems, and equipment being commissioned.
- B. The commissioning activities have been developed to support the VA requirements to meet guidelines for Federal Leadership in Environmental, Energy, and Economic Performance.

### 1.5 ACRONYMS

List of Acronyms	
Acronym	Meaning
A/E	Architect / Engineer Design Team
AHJ	Authority Having Jurisdiction
ASHRAE	Association Society for Heating Air Condition and Refrigeration Engineers
BOD	Basis of Design
BSC	Building Systems Commissioning
CCTV	Closed Circuit Television
CD	Construction Documents
CMMS	Computerized Maintenance Management System
CO	Contracting Officer (VA)
COR	Contracting Officer's Representative (see also VA-RE)
COBie	Construction Operations Building Information Exchange
CPC	Construction Phase Commissioning
Cx	Commissioning
CxA	Commissioning Agent
CxM	Commissioning Manager
CxR	Commissioning Representative
DPC	Design Phase Commissioning
FPT	Functional Performance Test
GBI-GG	Green Building Initiative - Green Globes
HVAC	Heating, Ventilation, and Air Conditioning
LEED	Leadership in Energy and Environmental Design

List of Acronyms	
Acronym	Meaning
NC	Department of Veterans Affairs National Cemetery
NCA	Department of Veterans Affairs National Cemetery Administration
NEBB	National Environmental Balancing Bureau
O&M	Operations & Maintenance
OPR	Owner's Project Requirements
PFC	Pre-Functional Checklist
PFT	Pre-Functional Test
SD	Schematic Design
SO	Site Observation
TAB	Test Adjust and Balance
VA	Department of Veterans Affairs
VAMC	VA Medical Center
VA CFM	VA Office of Construction and Facilities Management
VACO	VA Central Office
VA PM	VA Project Manager
VA-RE	VA Resident Engineer
USGBC	United States Green Building Council

## 1.6 DEFINITIONS

**Acceptance Phase Commissioning:** Commissioning tasks executed after most construction has been completed, most Site Observations and Static Tests have been completed and Pre-Functional Testing has been completed and accepted. The main commissioning activities performed during this phase are verification that the installed systems are functional by conducting Systems Functional Performance tests and Owner Training.

**Accuracy:** The capability of an instrument to indicate the true value of a measured quantity.

**Back Check:** A back check is a verification that an agreed upon solution to a design comment has been adequately addressed in a subsequent design review

**Basis of Design (BOD):** The Engineer's Basis of Design is comprised of two components: the Design Criteria and the Design Narrative, these documents record the concepts, calculations, decisions, and product

selections used to meet the Owner's Project Requirements (OPR) and to satisfy applicable regulatory requirements, standards, and guidelines.

**Benchmarks:** Benchmarks are the comparison of a building's energy usage to other similar buildings and to the building itself.. For example, ENERGY STAR Portfolio Manager is a frequently used and nationally recognized building energy benchmarking tool.

**Building Information Modeling (BIM):** Building Information Modeling is a parametric database which allows a building to be designed and constructed virtually in 3D, and provides reports both in 2D views and as schedules. This electronic information can be extracted and reused for pre-populating facility management CMMS systems. Building Systems Commissioning (BSC): NEBB acronym used to designate its commissioning program.

**Calibrate:** The act of comparing an instrument of unknown accuracy with a standard of known accuracy to detect, correlate, report, or eliminate by adjustment any variation in the accuracy of the tested instrument.

**CCTV:** Closed circuit Television. Normally used for security surveillance and alarm detections as part of a special electrical security system.

**COBie:** Construction Operations Building Information Exchange (COBie) is an electronic industry data format used to transfer information developed during design, construction, and commissioning into the Computer Maintenance Management Systems (CMMS) used to operate facilities. See the Whole Building Design Guide website for further information (<http://www.wbdg.org/resources/cobie.php>)

**Commissionability:** Defines a design component or construction process that has the necessary elements that will allow a system or component to be effectively measured, tested, operated and commissioned

**Commissioning Agent (CxA):** The qualified Commissioning Professional who administers the Cx process by managing the Cx team and overseeing the Commissioning Process. Where CxA is used in this specification it means the Commissioning Agent, members of his staff or appointed members of the commissioning team. Note that LEED uses the term Commissioning Authority in lieu of Commissioning Agent.

**Commissioning Checklists:** Lists of data or inspections to be verified to ensure proper system or component installation, operation, and function. Verification checklists are developed and used during all

phases of the commissioning process to verify that the Owner's Project Requirements (OPR) is being achieved.

**Commissioning Design Review:** The commissioning design review is a collaborative review of the design professionals design documents for items pertaining to the following: owner's project requirements; basis of design; operability and maintainability (O&M) including documentation; functionality; training; energy efficiency, control systems' sequence of operations including building automation system features; commissioning specifications and the ability to functionally test the systems.

**Commissioning Issue:** A condition identified by the Commissioning Agent or other member of the Commissioning Team that adversely affects the commissionability, operability, maintainability, or functionality of a system, equipment, or component. A condition that is in conflict with the Contract Documents and/or performance requirements of the installed systems and components. (See also - Commissioning Observation).

**Commissioning Manager (CxM):** A qualified individual appointed by the Contractor to manage the commissioning process on behalf of the Contractor.

**Commissioning Observation:** An issue identified by the Commissioning Agent or other member of the Commissioning Team that does not conform to the project OPR, contract documents or standard industry best practices. (See also Commissioning Issue)

**Commissioning Plan:** A document that outlines the commissioning process, commissioning scope and defines responsibilities, processes, schedules, and the documentation requirements of the Commissioning Process.

**Commissioning Process:** A quality focused process for enhancing the delivery of a project. The process focuses upon verifying and documenting that the facility and all of its systems, components, and assemblies are planned, designed, installed, tested, can be operated, and maintained to meet the Owner's Project Requirements.

**Commissioning Report:** The final commissioning document which presents the commissioning process results for the project. Cx reports include an executive summary, the commissioning plan, issue log, correspondence, and all appropriate check sheets and test forms.

**Commissioning Representative (CxR):** An individual appointed by a sub-contractor to manage the commissioning process on behalf of the sub-contractor.

**Commissioning Specifications:** The contract documents that detail the objective, scope and implementation of the commissioning process as developed in the Commissioning Plan.

**Commissioning Team:** Individual team members whose coordinated actions are responsible for implementing the Commissioning Process.

**Construction Phase Commissioning:** All commissioning efforts executed during the construction process after the design phase and prior to the Acceptance Phase Commissioning.

**Contract Documents (CD):** Contract documents include design and construction contracts, price agreements and procedure agreements. Contract Documents also include all final and complete drawings, specifications and all applicable contract modifications or supplements.

**Construction Phase Commissioning (CPC):** All commissioning efforts executed during the construction process after the design phase and prior to the Acceptance Phase Commissioning.

**Coordination Drawings:** Drawings showing the work of all trades that are used to illustrate that equipment can be installed in the space allocated without compromising equipment function or access for maintenance and replacement. These drawings graphically illustrate and dimension manufacturers' recommended maintenance clearances. On mechanical projects, coordination drawings include structural steel, ductwork, major piping and electrical conduit and show the elevations and locations of the above components.

**Data Logging:** The monitoring and recording of temperature, flow, current, status, pressure, etc. of equipment using stand-alone data recorders.

**Deferred System Test:** Tests that cannot be completed at the end of the acceptance phase due to ambient conditions, schedule issues or other conditions preventing testing during the normal acceptance testing period.

**Deficiency:** See "Commissioning Issue".

**Design Criteria:** A listing of the VA Design Criteria outlining the project design requirements, including its source. These are used during the design process to show the design elements meet the OPR.

**Design Intent:** The overall term that includes the OPR and the BOD. It is a detailed explanation of the ideas, concepts, and criteria that are defined by the owner to be important. The design intent documents are

utilized to provide a written record of these ideas, concepts and criteria.

**Design Narrative:** A written description of the proposed design solutions that satisfy the requirements of the OPR.

**Design Phase Commissioning (DPC):** All commissioning tasks executed during the design phase of the project.

**Environmental Systems:** Systems that use a combination of mechanical equipment, airflow, water flow and electrical energy to provide heating, ventilating, air conditioning, humidification, and dehumidification for the purpose of human comfort or process control of temperature and humidity.

**Executive Summary:** A section of the Commissioning report that reviews the general outcome of the project. It also includes any unresolved issues, recommendations for the resolution of unresolved issues and all deferred testing requirements.

**Functionality:** This defines a design component or construction process which will allow a system or component to operate or be constructed in a manner that will produce the required outcome of the OPR.

**Functional Test Procedure (FTP):** A written protocol that defines methods, steps, personnel, and acceptance criteria for tests conducted on components, equipment, assemblies, systems, and interfaces among systems.

**Industry Accepted Best Practice:** A design component or construction process that has achieved industry consensus for quality performance and functionality. Refer to the current edition of the NEBB Design Phase Commissioning Handbook for examples.

**Installation Verification:** Observations or inspections that confirm the system or component has been installed in accordance with the contract documents and to industry accepted best practices.

**Integrated System Testing:** Integrated Systems Testing procedures entail testing of multiple integrated systems performance to verify proper functional interface between systems. Typical Integrated Systems Testing includes verifying that building systems respond properly to loss of utility, transfer to emergency power sources, re-transfer from emergency power source to normal utility source; interface between HVAC controls and Fire Alarm systems for equipment shutdown, interface between Fire Alarm system and elevator control systems for elevator recall and shutdown; interface between Fire Alarm System and Security

Access Control Systems to control access to spaces during fire alarm conditions; and other similar tests as determined for each specific project.

**Issues Log:** A formal and ongoing record of problems or concerns – and their resolution – that have been raised by members of the Commissioning Team during the course of the Commissioning Process.

**Lessons Learned Workshop:** A workshop conducted to discuss and document project successes and identify opportunities for improvements for future projects.

**Maintainability:** A design component or construction process that will allow a system or component to be effectively maintained. This includes adequate room for access to adjust and repair the equipment. Maintainability also includes components that have readily obtainable repair parts or service.

**Manual Test:** Testing using hand-held instruments, immediate control system readouts or direct observation to verify performance (contrasted to analyzing monitored data taken over time to make the 'observation').

**Owner's Project Requirements (OPR):** A written document that details the project requirements and the expectations of how the building and its systems will be used and operated. These include project goals, measurable performance criteria, cost considerations, benchmarks, success criteria, and supporting information.

**Peer Review:** A formal in-depth review separate from the commissioning review processes. The level of effort and intensity is much greater than a typical commissioning facilitation or extended commissioning review. The VA usually hires an independent third-party (called the IDIQ A/E) to conduct peer reviews.

**Precision:** The ability of an instrument to produce repeatable readings of the same quantity under the same conditions. The precision of an instrument refers to its ability to produce a tightly grouped set of values around the mean value of the measured quantity.

**Pre-Design Phase Commissioning:** Commissioning tasks performed prior to the commencement of design activities that includes project programming and the development of the commissioning process for the project

**Pre-Functional Checklist (PFC):** A form used by the contractor to verify that appropriate components are onsite, correctly installed, set up, calibrated, functional and ready for functional testing.



**Pre-Functional Test (PFT):** An inspection or test that is done before functional testing. PFT's include installation verification and system and component start up tests.

**Procedure or Protocol:** A defined approach that outlines the execution of a sequence of work or operations. Procedures are used to produce repeatable and defined results.

**Range:** The upper and lower limits of an instrument's ability to measure the value of a quantity for which the instrument is calibrated.

**Resolution:** This word has two meanings in the Cx Process. The first refers to the smallest change in a measured variable that an instrument can detect. The second refers to the implementation of actions that correct a tested or observed deficiency.

**Site Observation Visit:** On-site inspections and observations made by the Commissioning Agent for the purpose of verifying component, equipment, and system installation, to observe contractor testing, equipment start-up procedures, or other purposes.

**Site Observation Reports (SO):** Reports of site inspections and observations made by the Commissioning Agent. Observation reports are intended to provide early indication of an installation issue which will need correction or analysis.

**Special System Inspections:** Inspections required by a local code authority prior to occupancy and are not normally a part of the commissioning process.

**Static Tests:** Tests or inspections that validate a specified static condition such as pressure testing. Static tests may be specification or code initiated.

**Start Up Tests:** Tests that validate the component or system is ready for automatic operation in accordance with the manufactures requirements.

**Systems Manual:** A system-focused composite document that includes all information required for the owners operators to operate the systems.

**Test Procedure:** A written protocol that defines methods, personnel, and expectations for tests conducted on components, equipment, assemblies, systems, and interfaces among systems.

**Testing:** The use of specialized and calibrated instruments to measure parameters such as: temperature, pressure, vapor flow, air flow, fluid flow, rotational speed, electrical characteristics, velocity, and other data in order to determine performance, operation, or function.

**Testing, Adjusting, and Balancing (TAB):** A systematic process or service applied to heating, ventilating and air-conditioning (HVAC) systems and other environmental systems to achieve and document air and hydronic flow rates. The standards and procedures for providing these services are referred to as "Testing, Adjusting, and Balancing" and are described in the Procedural Standards for the Testing, Adjusting and Balancing of Environmental Systems, published by NEBB or AABC.

**Thermal Scans:** Thermographic pictures taken with an Infrared Thermographic Camera. Thermographic pictures show the relative temperatures of objects and surfaces and are used to identify leaks, thermal bridging, thermal intrusion, electrical overload conditions, moisture containment, and insulation failure.

**Training Plan:** A written document that details, in outline form the expectations of the operator training. Training agendas should include instruction on how to obtain service, operate, startup, shutdown and maintain all systems and components of the project.

**Trending:** Monitoring over a period of time with the building automation system.

**Unresolved Commissioning Issue:** Any Commissioning Issue that, at the time that the Final Report or the Amended Final Report is issued that has not been either resolved by the construction team or accepted by the VA. Validation: The process by which work is verified as complete and operating correctly:

1. First party validation occurs when a firm or individual verifying the task is the same firm or individual performing the task.
2. Second party validation occurs when the firm or individual verifying the task is under the control of the firm performing the task or has other possibilities of financial conflicts of interest in the resolution (Architects, Designers, General Contractors and Third Tier Subcontractors or Vendors).
3. Third party validation occurs when the firm verifying the task is not associated with or under control of the firm performing or designing the task.

**Verification:** The process by which specific documents, components, equipment, assemblies, systems, and interfaces among systems are confirmed to comply with the criteria described in the Owner's Project Requirements.

**Warranty Phase Commissioning:** Commissioning efforts executed after a project has been completed and accepted by the Owner. Warranty Phase Commissioning includes follow-up on verification of system performance, measurement and verification tasks and assistance in identifying warranty issues and enforcing warranty provisions of the construction contract.

**Warranty Visit:** A commissioning meeting and site review where all outstanding warranty issues and deferred testing is reviewed and discussed.

**Whole Building Commissioning:** Commissioning of building systems such as Building Envelope, HVAC, Electrical, Special Electrical (Fire Alarm, Security & Communications), Plumbing and Fire Protection as described in this specification.

#### 1.7 SYSTEMS TO BE COMMISSIONED

- A. Commissioning of a system or systems specified for this project is part of the construction process. Documentation and testing of these systems, as well as training of the VA's Operation and Maintenance personnel, is required in cooperation with the VA and the Commissioning Agent.
- B. The following systems will be commissioned as part of this project:

Systems To Be Commissioned	
System	Description
<b>Fire Suppression</b>	
Fire Sprinkler Systems	Wet pipe system, dry pipe system, pre-action system, special agent systems
<b>HVAC</b>	
Noise and Vibration Control	Noise and vibration levels for critical equipment such as Air Handlers, Chillers, Cooling Towers, Boilers, Generators, etc. will be commissioned as part of the system commissioning

Systems To Be Commissioned	
System	Description
Direct Digital Control System**	Operator Interface Computer, Operator Work Station (including graphics, point mapping, trends, alarms), Network Communications Modules and Wiring, Integration Panels. [DDC Control panels will be commissioned with the systems controlled by the panel]
HVAC Terminal Unit Systems**	VAV Terminal Units, CAV terminal units, fan coil units, fin-tube radiation, unit heaters
<b>Electrical</b>	
Low-Voltage Distribution System	
	Normal power distribution system, Life-safety power distribution system, critical power distribution system, equipment power distribution system, switchboards, distribution panels, panelboards, verify breaker testing results (injection current, etc)
Lighting & Lighting Control** Systems	Emergency lighting, occupancy sensors, lighting control systems, architectural dimming systems, theatrical dimming systems, exterior lighting and controls
<b>Communications</b>	
Nurse Call & Code Blue Systems	Witness 3rd party testing, review reports
Security Emergency Call Systems	
	Witness 3rd party testing, review reports

Systems To Be Commissioned	
System	Description
<b>Electronic Safety and Security</b>	
Access Control Systems	Witness 3rd party testing, review reports
Fire Detection and Alarm System	100% device acceptance testing, battery draw-down test, verify system monitoring, verify interface with other systems.
<b>Renewable Energy Sources</b>	
<b>Site Utilities</b>	
Fire Alarm Response	Integrated System Response to Fire Alarm Condition and Return to Normal

#### 1.8 COMMISSIONING TEAM

- A. The commissioning team shall consist of, but not be limited to, representatives of Contractor, including Project Superintendent and subcontractors, installers, schedulers, suppliers, and specialists deemed appropriate by the Department of Veterans Affairs (VA) and/or Commissioning Agent.
- B. Members Appointed by Contractor:
1. Contractor' Commissioning Manager: The designated person, company, or entity that plans, schedules and coordinates the commissioning activities for the construction team.
  2. Contractor's Commissioning Representative(s): Individual(s), each having authority to act on behalf of the entity he or she represents, explicitly organized to implement the commissioning process through coordinated actions.
- C. Members Appointed by VA:
1. Commissioning Agent: The designated person, company, or entity that plans, schedules, and coordinates the commissioning team to implement the commissioning process. The VA will engage the CxA under a separate contract.

2. User: Representatives of the facility user and operation and maintenance personnel.
3. A/E: Representative of the Architect and engineering design professionals.

#### **1.9 VA'S COMMISSIONING RESPONSIBILITIES**

- A. Appoint an individual, company or firm to act as the Commissioning Agent.
- B. Assign operation and maintenance personnel and schedule them to participate in commissioning team activities including, but not limited to, the following:
  1. Coordination meetings.
  2. Training in operation and maintenance of systems, subsystems, and equipment.
  3. Testing meetings.
  4. Witness and assist in Systems Functional Performance Testing.
  5. Demonstration of operation of systems, subsystems, and equipment.
- C. Provide the Construction Documents, prepared by Architect and approved by VA, to the Commissioning Agent and for use in managing the commissioning process, developing the commissioning plan, systems manuals, and reviewing the operation and maintenance training plan.

#### **1.10 CONTRACTOR'S COMMISSIONING RESPONSIBILITIES**

- A. The Contractor shall assign a Commissioning Manager to manage commissioning activities of the Contractor, and subcontractors.
- B. The Contractor shall ensure that the commissioning responsibilities outlined in these specifications are included in all subcontracts and that subcontractors comply with the requirements of these specifications.
- C. The Contractor shall ensure that each installing subcontractor shall assign representatives with expertise and authority to act on behalf of the subcontractor and schedule them to participate in and perform commissioning team activities including, but not limited to, the following:
  1. Participate in commissioning coordination meetings.
  2. Conduct operation and maintenance training sessions in accordance with approved training plans.
  3. Verify that Work is complete and systems are operational according to the Contract Documents, including calibration of instrumentation and controls.

4. Evaluate commissioning issues and commissioning observations identified in the Commissioning Issues Log, field reports, test reports or other commissioning documents. In collaboration with entity responsible for system and equipment installation, recommend corrective action.
5. Review and comment on commissioning documentation.
6. Participate in meetings to coordinate Systems Functional Performance Testing.
7. Provide schedule for operation and maintenance data submittals, equipment startup, and testing to Commissioning Agent for incorporation into the commissioning plan.
8. Provide information to the Commissioning Agent for developing commissioning plan.
9. Participate in training sessions for VA's operation and maintenance personnel.
10. Provide technicians who are familiar with the construction and operation of installed systems and who shall develop specific test procedures to conduct Systems Functional Performance Testing of installed systems.

#### **1.11 COMMISSIONING AGENT'S RESPONSIBILITIES**

- A. Organize and lead the commissioning team.
- B. Prepare the commissioning plan. See Paragraph 1.11-A of this specification Section for further information.
- C. Review and comment on selected submittals from the Contractor for general conformance with the Construction Documents. Review and comment on the ability to test and operate the system and/or equipment, including providing gages, controls and other components required to operate, maintain, and test the system. Review and comment on performance expectations of systems and equipment and interfaces between systems relating to the Construction Documents.
- D. At the beginning of the construction phase, conduct an initial construction phase coordination meeting for the purpose of reviewing the commissioning activities and establishing tentative schedules for operation and maintenance submittals; operation and maintenance training sessions; TAB Work; Pre-Functional Checklists, Systems Functional Performance Testing; and project completion.
- E. Convene commissioning team meetings for the purpose of coordination, communication, and conflict resolution; discuss status of the

commissioning processes. Responsibilities include arranging for facilities, preparing agenda and attendance lists, and notifying participants. The Commissioning Agent shall prepare and distribute minutes to commissioning team members and attendees within five workdays of the commissioning meeting.

- F. Observe construction and report progress, observations and issues. Observe systems and equipment installation for adequate accessibility for maintenance and component replacement or repair, and for general conformance with the Construction Documents.
- G. Prepare Project specific Pre-Functional Checklists and Systems Functional Performance Test procedures.
- H. Coordinate Systems Functional Performance Testing schedule with the Contractor.
- I. Witness selected systems startups.
- J. Verify selected Pre-Functional Checklists completed and submitted by the Contractor.
- K. Witness and document Systems Functional Performance Testing.
- L. Compile test data, inspection reports, and certificates and include them in the systems manual and commissioning report.

Spec Writer's Note: Coordinate the specification reference in Para J below with the specific project spec section dealing with O&M Data requirements.

- M. Review and comment on operation and maintenance (O&M) documentation and systems manual outline for compliance with the Contract Documents. Operation and maintenance documentation requirements are specified in Paragraph 1.25, Section 01 00 00 GENERAL REQUIREMENTS.
- N. Review operation and maintenance training program developed by the Contractor. Verify training plans provide qualified instructors to conduct operation and maintenance training.
- O. Prepare commissioning Field Observation Reports.
- P. Prepare the Final Commissioning Report.
- Q. Return to the site at 10 months into the 12 month warranty period and review with facility staff the current building operation and the condition of outstanding issues related to the original and seasonal Systems Functional Performance Testing. Also interview facility staff and identify problems or concerns they have operating the building as



originally intended. Make suggestions for improvements and for recording these changes in the O&M manuals. Identify areas that may come under warranty or under the original construction contract. Assist facility staff in developing reports, documents and requests for services to remedy outstanding problems.

- R. Assemble the final commissioning documentation, including the Final Commissioning Report and Addendum to the Final Commissioning Report.

#### **1.12 COMMISSIONING DOCUMENTATION**

- A. Commissioning Plan: A document, prepared by Commissioning Agent, that outlines the schedule, allocation of resources, and documentation requirements of the commissioning process, and shall include, but is not limited, to the following:
  1. Plan for delivery and review of submittals, systems manuals, and other documents and reports. Identification of the relationship of these documents to other functions and a detailed description of submittals that are required to support the commissioning processes. Submittal dates shall include the latest date approved submittals must be received without adversely affecting commissioning plan.
  2. Description of the organization, layout, and content of commissioning documentation (including systems manual) and a detailed description of documents to be provided along with identification of responsible parties.
  3. Identification of systems and equipment to be commissioned.
  4. Schedule of Commissioning Coordination meetings.
  5. Identification of items that must be completed before the next operation can proceed.
  6. Description of responsibilities of commissioning team members.
  7. Description of observations to be made.
  8. Description of requirements for operation and maintenance training.
  9. Schedule for commissioning activities with dates coordinated with overall construction schedule.
  10. Process and schedule for documenting changes on a continuous basis to appear in Project Record Documents.
  11. Process and schedule for completing prestart and startup checklists for systems, subsystems, and equipment to be verified and tested.
  12. Preliminary Systems Functional Performance Test procedures.
- B. Systems Functional Performance Test Procedures: The Commissioning Agent will develop Systems Functional Performance Test Procedures for

each system to be commissioned, including subsystems, or equipment and interfaces or interlocks with other systems. Systems Functional Performance Test Procedures will include a separate entry, with space for comments, for each item to be tested. Preliminary Systems Functional Performance Test Procedures will be provided to the VA, Architect/Engineer, and Contractor for review and comment. The Systems Performance Test Procedure will include test procedures for each mode of operation and provide space to indicate whether the mode under test responded as required. Each System Functional Performance Test procedure, regardless of system, subsystem, or equipment being tested, shall include, but not be limited to, the following:

1. Name and identification code of tested system.
  2. Test number.
  3. Time and date of test.
  4. Indication of whether the record is for a first test or retest following correction of a problem or issue.
  5. Dated signatures of the person performing test and of the witness, if applicable.
  6. Individuals present for test.
  7. Observations and Issues.
  8. Issue number, if any, generated as the result of test.
- C. Pre-Functional Checklists: The Commissioning Agent will prepare Pre-Functional Checklists. Pre-Functional Checklists shall be completed and signed by the Contractor, verifying that systems, subsystems, equipment, and associated controls are ready for testing. The Commissioning Agent will spot check Pre-Functional Checklists to verify accuracy and readiness for testing. Inaccurate or incomplete Pre-Functional Checklists shall be returned to the Contractor for correction and resubmission.
- D. Test and Inspection Reports: The Commissioning Agent will record test data, observations, and measurements on Systems Functional Performance Test Procedure. The report will also include recommendation for system acceptance or non-acceptance. Photographs, forms, and other means appropriate for the application shall be included with data. Commissioning Agent Will compile test and inspection reports and test and inspection certificates and include them in systems manual and commissioning report.

E. Corrective Action Documents: The Commissioning Agent will document corrective action taken for systems and equipment that fail tests. The documentation will include any required modifications to systems and equipment and/or revisions to test procedures, if any. The Commissioning Agent will witness and document any retesting of systems and/or equipment requiring corrective action and document retest results. Contractor is liable for any costs incurred by the VA for retesting. These costs may include additional fees to the Commissioning Agent and/or A/E.

F. Commissioning Issues Log: The Commissioning Agent will prepare and maintain Commissioning Issues Log that describes Commissioning Issues and Commissioning Observations that are identified during the Commissioning process. These observations and issues include, but are not limited to, those that are at variance with the Contract Documents. The Commissioning Issues Log will identify and track issues as they are encountered, the party responsible for resolution, progress toward resolution, and document how the issue was resolved. The Master Commissioning Issues Log will also track the status of unresolved issues.

1. Creating an Commissioning Issues Log Entry:

- a. Identify the issue with unique numeric or alphanumeric identifier by which the issue may be tracked.
- b. Assign a descriptive title for the issue.
- c. Identify date and time of the issue.
- d. Identify test number of test being performed at the time of the observation, if applicable, for cross reference.
- e. Identify system, subsystem, and equipment to which the issue applies.
- f. Identify location of system, subsystem, and equipment.
- g. Include information that may be helpful in diagnosing or evaluating the issue.
- h. Note recommended corrective action.
- i. Identify commissioning team member responsible for corrective action.
- j. Identify expected date of correction.
- k. Identify person that identified the issue.

2. Documenting Issue Resolution:

- a. Log date correction is completed or the issue is resolved.

- b. Describe corrective action or resolution taken. Include description of diagnostic steps taken to determine root cause of the issue, if any.
  - c. Identify changes to the Contract Documents that may require action.
  - d. State that correction was completed and system, subsystem, and equipment are ready for retest, if applicable.
  - e. Identify person(s) who corrected or resolved the issue.
  - f. Identify person(s) verifying the issue resolution.
- G. Final Commissioning Report: The Commissioning Agent will document results of the commissioning process, including unresolved issues, and performance of systems, subsystems, and equipment. The Commissioning Report will indicate whether systems, subsystems, and equipment have been properly installed and are performing according to the Contract Documents. This report will be used by the Department of Veterans Affairs when determining that systems will be accepted. This report will be used to evaluate systems, subsystems, and equipment and will serve as a future reference document during VA occupancy and operation. It shall describe components and performance that exceed requirements of the Contract Documents and those that do not meet requirements of the Contract Documents. The commissioning report will include, but is not limited to, the following:
  - 1. Lists and explanations of substitutions; compromises; variances with the Contract Documents; record of conditions; and, if appropriate, recommendations for resolution. Design Narrative documentation maintained by the Commissioning Agent.
  - 2. Commissioning plan.
  - 3. Pre-Functional Checklists completed by the Contractor, with annotation of the Commissioning Agent review and spot check.
  - 4. Systems Functional Performance Test Procedures, with annotation of test results and test completion.
  - 5. Commissioning Issues Log.
  - 6. Listing of deferred and off season test(s) not performed, including the schedule for their completion.
- H. Addendum to Final Commissioning Report: The Commissioning Agent will prepare an Addendum to the Final Commissioning Report near the end of the Warranty Period. The Addendum will indicate whether systems, subsystems, and equipment are complete and continue to perform

according to the Contract Documents. The Addendum to the Final Commissioning Report shall include, but is not limited to, the following:

1. Documentation of deferred and off season test(s) results.
  2. Completed Systems Functional Performance Test Procedures for off season test(s).
  3. Documentation that unresolved system performance issues have been resolved.
  4. Updated Commissioning Issues Log, including status of unresolved issues.
  5. Identification of potential Warranty Claims to be corrected by the Contractor.
- I. Systems Manual: The Commissioning Agent will gather required information and compile the Systems Manual. The Systems Manual will include, but is not limited to, the following:
1. Design Narrative, including system narratives, schematics, single-line diagrams, flow diagrams, equipment schedules, and changes made throughout the Project.
  2. Reference to Final Commissioning Plan.
  3. Reference to Final Commissioning Report.
  4. Approved Operation and Maintenance Data as submitted by the Contractor.

### **1.13 SUBMITTALS**

- A. Preliminary Commissioning Plan Submittal: The Preliminary Commissioning Plan is provided for information only. It contains preliminary information about the following commissioning activities:
1. The Commissioning Team: A list of commissioning team members by organization.
  2. Systems to be commissioned. A detailed list of systems to be commissioned for the project. This list also provides preliminary information on systems/equipment submittals to be reviewed by the Commissioning Agent; preliminary information on Pre-Functional Checklists that are to be completed; preliminary information on Systems Performance Testing, including information on testing sample size (where authorized by the VA).
  3. Commissioning Team Roles and Responsibilities: Preliminary roles and responsibilities for each Commissioning Team member.

4. Commissioning Documents: A preliminary list of commissioning-related documents, include identification of the parties responsible for preparation, review, approval, and action on each document.
  5. Commissioning Activities Schedule: Identification of Commissioning Activities, including Systems Functional Testing, the expected duration and predecessors for the activity.
  6. Pre-Functional Checklists: Preliminary Pre-Functional Checklists for equipment, components, subsystems, and systems to be commissioned. These Preliminary Pre-Functional Checklists provide guidance on the level of detailed information the Contractor shall include on the final submission.
  7. Systems Functional Performance Test Procedures: Preliminary step-by-step System Functional Performance Test Procedures to be used during Systems Functional Performance Testing. These Preliminary Systems Functional Performance procedures provide information on the level of testing rigor, and the level of Contractor support required during performance of system's testing.
- B. Final Commissioning Plan Submittal: Based on the Final Construction Documents and the Contractor's project team, the Commissioning Agent will prepare the Final Commissioning Plan as described in this section. The Commissioning Agent will submit three hard copies and three sets of electronic files of Final Commissioning Plan. The Contractor shall review the Commissioning Plan and provide any comments to the VA. The Commissioning Agent will incorporate review comments into the Final Commissioning Plan as directed by the VA.
- C. Systems Functional Performance Test Procedure: The Commissioning Agent will submit preliminary Systems Functional Performance Test Procedures to the Contractor, and the VA for review and comment. The Contractor shall return review comments to the VA and the Commissioning Agent. The VA will also return review comments to the Commissioning Agent. The Commissioning Agent will incorporate review comments into the Final Systems Functional Test Procedures to be used in Systems Functional Performance Testing.
- D. Pre-Functional Checklists: The Commissioning Agent will submit Pre-Functional Checklists to be completed by the Contractor.
- E. Test and Inspection Reports: The Commissioning Agent will submit test and inspection reports to the VA with copies to the Contractor and the Architect/Engineer.

- F. Corrective Action Documents: The Commissioning Agent will submit corrective action documents to the VA Resident Engineer with copies to the Contractor and Architect.
- G. Preliminary Commissioning Report Submittal: The Commissioning Agent will submit three electronic copies of the preliminary commissioning report. One electronic copy, with review comments, will be returned to the Commissioning Agent for preparation of the final submittal.
- H. Final Commissioning Report Submittal: The Commissioning Agent will submit four sets of electronically formatted information of the final commissioning report to the VA. The final submittal will incorporate comments as directed by the VA.
- I. Data for Commissioning:
  - 1. The Commissioning Agent will request in writing from the Contractor specific information needed about each piece of commissioned equipment or system to fulfill requirements of the Commissioning Plan.
  - 2. The Commissioning Agent may request further documentation as is necessary for the commissioning process or to support other VA data collection requirements, including Construction Operations Building Information Exchange (COBIE), Building Information Modeling (BIM), etc.

#### **1.14 COMMISSIONING PROCESS**

- A. The Commissioning Agent will be responsible for the overall management of the commissioning process as well as coordinating scheduling of commissioning tasks with the VA and the Contractor. As directed by the VA, the Contractor shall incorporate Commissioning tasks, including, but not limited to, Systems Functional Performance Testing (including predecessors) with the Master Construction Schedule.
- B. Within 7 days of contract award, the Contractor shall designate a specific individual as the Commissioning Manager (CxM) to manage and lead the commissioning effort on behalf of the Contractor. The Commissioning Manager shall be the single point of contact and communications for all commissioning related services by the Contractor.
- C. Within 7 days of contract award, the Contractor shall ensure that each subcontractor designates specific individuals as Commissioning Representatives (CXR) to be responsible for commissioning related

tasks. The Contractor shall ensure the designated Commissioning Representatives participate in the commissioning process as team members providing commissioning testing services, equipment operation, adjustments, and corrections if necessary. The Contractor shall ensure that all Commissioning Representatives shall have sufficient authority to direct their respective staff to provide the services required, and to speak on behalf of their organizations in all commissioning related contractual matters.

#### **1.15 QUALITY ASSURANCE**

- A. Instructor Qualifications: Factory authorized service representatives shall be experienced in training, operation, and maintenance procedures for installed systems, subsystems, and equipment.
- B. Test Equipment Calibration: The Contractor shall comply with test equipment manufacturer's calibration procedures and intervals. Recalibrate test instruments immediately whenever instruments have been repaired following damage or dropping. Affix calibration tags to test instruments. Instruments shall have been calibrated within six months prior to use.

#### **1.16 COORDINATION**

- A. Management: The Commissioning Agent will coordinate the commissioning activities with the VA and Contractor. The Commissioning Agent will submit commissioning documents and information to the VA. All commissioning team members shall work together to fulfill their contracted responsibilities and meet the objectives of the contract documents.
- B. Scheduling: The Contractor shall work with the Commissioning Agent and the VA to incorporate the commissioning activities into the construction schedule. The Commissioning Agent will provide sufficient information (including, but not limited to, tasks, durations and predecessors) on commissioning activities to allow the Contractor and the VA to schedule commissioning activities. All parties shall address scheduling issues and make necessary notifications in a timely manner in order to expedite the project and the commissioning process. The Contractor shall update the Master Construction as directed by the VA.
- C. Initial Schedule of Commissioning Events: The Commissioning Agent will provide the initial schedule of primary commissioning events in the Commissioning Plan and at the commissioning coordination meetings. The Commissioning Plan will provide a format for this schedule. As



construction progresses, more detailed schedules will be developed by the Contractor with information from the Commissioning Agent.

- D. Commissioning Coordinating Meetings: The Commissioning Agent will conduct periodic Commissioning Coordination Meetings of the commissioning team to review status of commissioning activities, to discuss scheduling conflicts, and to discuss upcoming commissioning process activities.
- E. Pretesting Meetings: The Commissioning Agent will conduct pretest meetings of the commissioning team to review startup reports, Pre-Functional Checklist results, Systems Functional Performance Testing procedures, testing personnel and instrumentation requirements.
- F. Systems Functional Performance Testing Coordination: The Contractor shall coordinate testing activities to accommodate required quality assurance and control services with a minimum of delay and to avoid necessity of removing and replacing construction to accommodate testing and inspecting. The Contractor shall coordinate the schedule times for tests, inspections, obtaining samples, and similar activities.

## **PART 2 - PRODUCTS**

### **2.1 TEST EQUIPMENT**

- A. The Contractor shall provide all standard and specialized testing equipment required to perform Systems Functional Performance Testing. Test equipment required for Systems Functional Performance Testing will be identified in the detailed System Functional Performance Test Procedure prepared by the Commissioning Agent.
- B. Data logging equipment and software required to test equipment shall be provided by the Contractor.
- C. All testing equipment shall be of sufficient quality and accuracy to test and/or measure system performance with the tolerances specified in the Specifications. If not otherwise noted, the following minimum requirements apply: Temperature sensors and digital thermometers shall have a certified calibration within the past year to an accuracy of 0.5 °C (1.0 °F) and a resolution of + or - 0.1 °C (0.2 °F). Pressure sensors shall have an accuracy of + or - 2.0% of the value range being measured (not full range of meter) and have been calibrated within the last year. All equipment shall be calibrated according to the manufacturer's recommended intervals and following any repairs to the equipment. Calibration tags shall be affixed or certificates readily available.

**PART 3 - EXECUTION****3.1 COMMISSIONING PROCESS ROLES AND RESPONSIBILITIES**

A. The following table outlines the roles and responsibilities for the Commissioning Team members during the Construction Phase:

Construction Phase		CxA = Commissioning Agent RE = Resident Engineer A/E = Design Arch/Engineer PC = Prime Contractor O&M = Gov't Facility O&M					L = Lead P = Participate A = Approve R = Review O = Optional
Commissioning Roles & Responsibilities							
Category	Task Description	CxA	RE	A/E	PC	O&M	Notes
Meetings	Construction Commissioning Kick Off meeting	L	A	P	P	O	
	Commissioning Meetings	L	A	P	P	O	
	Project Progress Meetings	P	A	P	L	O	
	Controls Meeting	L	A	P	P	O	
Coordination	Coordinate with [OGC's, AHJ, Vendors, etc.] to ensure that Cx interacts properly with other systems as needed to support the OPR and BOD.	L	A	P	P	N/A	
Cx Plan & Spec	Final Commissioning Plan	L	A	R	R	O	
Schedules	Duration Schedule for Commissioning Activities	L	A	R	R	N/A	
OPR and BOD	Maintain OPR on behalf of Owner	L	A	R	R	O	

Construction Phase		CxA = Commissioning Agent RE = Resident Engineer A/E = Design Arch/Engineer PC = Prime Contractor O&M = Gov't Facility O&M					L = Lead P = Participate A = Approve R = Review O = Optional
Commissioning Roles & Responsibilities							
Category	Task Description	CxA	RE	A/E	PC	O&M	Notes
	Maintain BOD/DID on behalf of Owner	L	A	R	R	O	
Document Reviews	TAB Plan Review	L	A	R	R	O	
	Submittal and Shop Drawing Review	R	A	R	L	O	
	Review Contractor Equipment Startup Checklists	L	A	R	R	N/A	
	Review Change Orders, ASI, and RFI	L	A	R	R	N/A	
Site Observations	Witness Factory Testing	P	A	P	L	O	
	Construction Observation Site Visits	L	A	R	R	O	
Functional Test Protocols	Final Pre-Functional Checklists	L	A	R	R	O	
	Final Functional Performance Test Protocols	L	A	R	R	O	
Technical Activities	Issues Resolution Meetings	P	A	P	L	O	
Reports and Logs	Status Reports	L	A	R	R	O	
	Maintain Commissioning Issues Log	L	A	R	R	O	

Construction Phase		CxA = Commissioning Agent RE = Resident Engineer A/E = Design Arch/Engineer PC = Prime Contractor O&M = Gov't Facility O&M					L = Lead P = Participate A = Approve R = Review O = Optional
Commissioning Roles & Responsibilities							
Category	Task Description	CxA	RE	A/E	PC	O&M	Notes

B. The following table outlines the roles and responsibilities for the Commissioning Team members during the Acceptance Phase:

Acceptance Phase		CxA = Commissioning Agent RE = Resident Engineer A/E = Design Arch/Engineer PC = Prime Contractor O&M = Gov't Facility O&M					L = Lead P = Participate A = Approve R = Review O = Optional
Commissioning Roles & Responsibilities							
Category	Task Description	CxA	RE	A/E	PC	O&M	Notes
Meetings	Commissioning Meetings	L	A	P	P	O	
	Project Progress Meetings	P	A	P	L	O	
	Pre-Test Coordination Meeting	L	A	P	P	O	
	Lessons Learned and Commissioning Report Review Meeting	L	A	P	P	O	
Coordination	Coordinate with [OGC's, AHJ, Vendors, etc.] to ensure that Cx interacts properly with other systems as needed to support OPR and BOD	L	P	P	P	O	
Cx Plan & Spec	Maintain/Update Commissioning Plan	L	A	R	R	O	

Acceptance Phase		CxA = Commissioning Agent					L = Lead
Commissioning Roles & Responsibilities		RE = Resident Engineer					P = Participate
		A/E = Design Arch/Engineer					A = Approve
		PC = Prime Contractor					R = Review
		O&M = Gov't Facility O&M					O = Optional
Category	Task Description	CxA	RE	A/E	PC	O&M	Notes
Schedules	Prepare Functional Test Schedule	L	A	R	R	O	
OPR and BOD	Maintain OPR on behalf of Owner	L	A	R	R	O	
	Maintain BOD/DID on behalf of Owner	L	A	R	R	O	
Document Reviews	Review Completed Pre-Functional Checklists	L	A	R	R	O	
	Pre-Functional Checklist Verification	L	A	R	R	O	
	Review Operations & Maintenance Manuals	L	A	R	R	R	
	Training Plan Review	L	A	R	R	R	
	Warranty Review	L	A	R	R	O	
	Review TAB Report	L	A	R	R	O	
Site Observations	Construction Observation Site Visits	L	A	R	R	O	
	Witness Selected Equipment Startup	L	A	R	R	O	
Functional Test Protocols	TAB Verification	L	A	R	R	O	
	Systems Functional Performance Testing	L	A	P	P	P	
	Retesting	L	A	P	P	P	
Technical Activities	Issues Resolution Meetings	P	A	P	L	O	
	Systems Training	L	S	R	P	P	

<b>Acceptance Phase</b>		CxA = Commissioning Agent					L = Lead
Commissioning Roles & Responsibilities		RE = Resident Engineer					P = Participate
		A/E = Design Arch/Engineer					A = Approve
		PC = Prime Contractor					R = Review
		O&M = Gov't Facility O&M					O = Optional
Category	Task Description	CxA	RE	A/E	PC	O&M	Notes
Reports and Logs	Status Reports	L	A	R	R	O	
	Maintain Commissioning Issues Log	L	A	R	R	O	
	Final Commissioning Report	L	A	R	R	R	
	Prepare Systems Manuals	L	A	R	R	R	

C. The following table outlines the roles and responsibilities for the Commissioning Team members during the Warranty Phase:

Warranty Phase		CxA = Commissioning Agent					L = Lead
Commissioning Roles & Responsibilities		RE = Resident Engineer					P = Participate
		A/E = Design Arch/Engineer					A = Approve
		PC = Prime Contractor					R = Review
		O&M = Gov't Facility O&M					O = Optional
Category	Task Description	CxA	RE	A/E	PC	O&M	Notes
Meetings	Post-Occupancy User Review Meeting	L	A	O	P	P	
Site Observations	Periodic Site Visits	L	A	O	O	P	
Functional Test Protocols	Deferred and/or seasonal Testing	L	A	O	P	P	
Technical Activities	Issues Resolution Meetings	L	S	O	O	P	
	Post-Occupancy Warranty Checkup and review of Significant Outstanding Issues	L	A		R	P	
Reports and Logs	Final Commissioning Report Amendment	L	A		R	R	
	Status Reports	L	A		R	R	

### 3.2 STARTUP, INITIAL CHECKOUT, AND PRE-FUNCTIONAL CHECKLISTS

A. The following procedures shall apply to all equipment and systems to be commissioned, according to Part 1, Systems to Be Commissioned.

1. Pre-Functional Checklists are important to ensure that the equipment and systems are hooked up and operational. These ensure that Systems Functional Performance Testing may proceed without unnecessary delays. Each system to be commissioned shall have a full Pre-Functional Checklist completed by the Contractor prior to Systems Functional Performance Testing. No sampling strategies are used.

a. The Pre-Functional Checklist will identify the trades responsible for completing the checklist. The Contractor shall ensure the appropriate trades complete the checklists.

b. The Commissioning Agent will review completed Pre-Functional Checklists and field-verify the accuracy of the completed checklist using sampling techniques.

2. Startup and Initial Checkout Plan: The Contractor shall develop detailed startup plans for all equipment. The primary role of the Contractor in this process is to ensure that there is written documentation that each of the manufacturer recommended procedures have been completed. Parties responsible for startup shall be identified in the Startup Plan and in the checklist forms.

a. The Contractor shall develop the full startup plan by combining (or adding to) the checklists with the manufacturer's detailed startup and checkout procedures from the O&M manual data and the field checkout sheets normally used by the Contractor. The plan shall include checklists and procedures with specific boxes or lines for recording and documenting the checking and inspections of each procedure and a summary statement with a signature block at the end of the plan.

b. The full startup plan shall at a minimum consist of the following items:

1) The Pre-Functional Checklists.

2) The manufacturer's standard written startup procedures copied from the installation manuals with check boxes by each procedure and a signature block added by hand at the end.

3) The manufacturer's normally used field checkout sheets.

c. The Commissioning Agent will submit the full startup plan to the VA and Contractor for review. Final approval will be by the VA.



- d. The Contractor shall review and evaluate the procedures and the format for documenting them, noting any procedures that need to be revised or added.
3. Sensor and Actuator Calibration
- a. All field installed temperature, relative humidity, CO2 and pressure sensors and gages, and all actuators (dampers and valves) on all equipment shall be calibrated using the methods described in Division 21, Division 22, Division 23, Division 26, Division 27, and Division 28 specifications.
  - b. All procedures used shall be fully documented on the Pre-Functional Checklists or other suitable forms, clearly referencing the procedures followed and written documentation of initial, intermediate and final results.
4. Execution of Equipment Startup
- a. Fourweeks prior to equipment startup, the Contractor shall schedule startup and checkout with the VA and Commissioning Agent. The performance of the startup and checkout shall be directed and executed by the Contractor.
  - b. The Commissioning Agent will observe the startup procedures for selected pieces of primary equipment.
  - c. The Contractor shall execute startup and provide the VA and Commissioning Agent with a signed and dated copy of the completed startup checklists, and contractor tests.
  - d. Only individuals that have direct knowledge and witnessed that a line item task on the Startup Checklist was actually performed shall initial or check that item off. It is not acceptable for witnessing supervisors to fill out these forms.

### **3.3 DEFICIENCIES, NONCONFORMANCE, AND APPROVAL IN CHECKLISTS AND STARTUP**

- A. The Contractor shall clearly list any outstanding items of the initial startup and Pre-Functional Checklist procedures that were not completed successfully, at the bottom of the procedures form or on an attached sheet. The procedures form and any outstanding deficiencies shall be provided to the VA and the Commissioning Agent within two days of completion.
- B. The Commissioning Agent will review the report and submit comments to the VA. The Commissioning Agent will work with the Contractor to correct and verify deficiencies or uncompleted items. The Commissioning

Agent will involve the VA and others as necessary. The Contractor shall correct all areas that are noncompliant or incomplete in the checklists in a timely manner, and shall notify the VA and Commissioning Agent as soon as outstanding items have been corrected. The Contractor shall submit an updated startup report and a Statement of Correction on the original noncompliance report. When satisfactorily completed, the Commissioning Agent will recommend approval of the checklists and startup of each system to the VA.

- C. The Contractor shall be responsible for resolution of deficiencies as directed the VA.

#### **3.4 PHASED COMMISSIONING - N/A**

#### **3.5 DDC SYSTEM TRENDING FOR COMMISSIONING - N/A**

#### **3.6 SYSTEMS FUNCTIONAL PERFORMANCE TESTING**

- A. This paragraph applies to Systems Functional Performance Testing of systems for all referenced specification Divisions.
- B. Objectives and Scope: The objective of Systems Functional Performance Testing is to demonstrate that each system is operating according to the Contract Documents. Systems Functional Performance Testing facilitates bringing the systems from a state of substantial completion to full dynamic operation. Additionally, during the testing process, areas of noncompliant performance are identified and corrected, thereby improving the operation and functioning of the systems. In general, each system shall be operated through all modes of operation (seasonal, occupied, unoccupied, warm-up, cool-down, part- and full-load, fire alarm and emergency power) where there is a specified system response. The Contractor shall verify each sequence in the sequences of operation. Proper responses to such modes and conditions as power failure, freeze condition, low oil pressure, no flow, equipment failure, etc. shall also be tested.
- C. Development of Systems Functional Performance Test Procedures: Before Systems Functional Performance Test procedures are written, the Contractor shall submit all requested documentation and a current list of change orders affecting equipment or systems, including an updated points list, program code, control sequences and parameters. Using the testing parameters and requirements found in the Contract Documents and approved submittals and shop drawings, the Commissioning Agent will develop specific Systems Functional Test Procedures to verify and

document proper operation of each piece of equipment and system to be commissioned. The Contractor shall assist the Commissioning Agent in developing the Systems Functional Performance Test procedures as requested by the Commissioning Agent i.e. by answering questions about equipment, operation, sequences, etc. Prior to execution, the Commissioning Agent will provide a copy of the Systems Functional Performance Test procedures to the VA, the Architect/Engineer, and the Contractor, who shall review the tests for feasibility, safety, equipment and warranty protection.

D. Purpose of Test Procedures: The purpose of each specific Systems Functional Performance Test is to verify and document compliance with the stated criteria of acceptance given on the test form. Representative test formats and examples are found in the Commissioning Plan for this project. (The Commissioning Plan is issued as a separate document and is available for review.) The test procedure forms developed by the Commissioning Agent will include, but not be limited to, the following information:

1. System and equipment or component name(s)
2. Equipment location and ID number
3. Unique test ID number, and reference to unique Pre-Functional Checklists and startup documentation, and ID numbers for the piece of equipment
4. Date
5. Project name
6. Participating parties
7. A copy of the specification section describing the test requirements
8. A copy of the specific sequence of operations or other specified parameters being verified
9. Formulas used in any calculations
10. Required pretest field measurements
11. Instructions for setting up the test.
12. Special cautions, alarm limits, etc.
13. Specific step-by-step procedures to execute the test, in a clear, sequential and repeatable format
14. Acceptance criteria of proper performance with a Yes / No check box to allow for clearly marking whether or not proper performance of each part of the test was achieved.
15. A section for comments.

16. Signatures and date block for the Commissioning Agent. A place for the Contractor to initial to signify attendance at the test.

E. Test Methods: Systems Functional Performance Testing shall be achieved by manual testing (i.e. persons manipulate the equipment and observe performance) and/or by monitoring the performance and analyzing the results using the control system's trend log capabilities or by standalone data loggers. The Contractor and Commissioning Agent shall determine which method is most appropriate for tests that do not have a method specified.

1. Simulated Conditions: Simulating conditions (not by an overwritten value) shall be allowed, although timing the testing to experience actual conditions is encouraged wherever practical.
2. Overwritten Values: Overwriting sensor values to simulate a condition, such as overwriting the outside air temperature reading in a control system to be something other than it really is, shall be allowed, but shall be used with caution and avoided when possible. Such testing methods often can only test a part of a system, as the interactions and responses of other systems will be erroneous or not applicable. Simulating a condition is preferable. e.g., for the above case, by heating the outside air sensor with a hair blower rather than overwriting the value or by altering the appropriate setpoint to see the desired response. Before simulating conditions or overwriting values, sensors, transducers and devices shall have been calibrated.
3. Simulated Signals: Using a signal generator which creates a simulated signal to test and calibrate transducers and DDC constants is generally recommended over using the sensor to act as the signal generator via simulated conditions or overwritten values.
4. Altering Setpoints: Rather than overwriting sensor values, and when simulating conditions is difficult, altering setpoints to test a sequence is acceptable. For example, to see the Air Conditioning compressor lockout initiate at an outside air temperature below 12 C (54 F), when the outside air temperature is above 12 C (54 F), temporarily change the lockout setpoint to be 2 C (4 F) above the current outside air temperature.
5. Indirect Indicators: Relying on indirect indicators for responses or performance shall be allowed only after visually and directly verifying and documenting, over the range of the tested parameters,

that the indirect readings through the control system represent actual conditions and responses. Much of this verification shall be completed during systems startup and initial checkout.

- F. Setup: Each function and test shall be performed under conditions that simulate actual conditions as closely as is practically possible. The Contractor shall provide all necessary materials, system modifications, etc. to produce the necessary flows, pressures, temperatures, etc. necessary to execute the test according to the specified conditions. At completion of the test, the Contractor shall return all affected building equipment and systems, due to these temporary modifications, to their pretest condition.
- G. Sampling: No sampling is allowed in completing Pre-Functional Checklists. Sampling is allowed for Systems Functional Performance Test Procedures execution. The Commissioning Agent will determine the sampling rate. If at any point, frequent failures are occurring and testing is becoming more troubleshooting than verification, the Commissioning Agent may stop the testing and require the Contractor to perform and document a checkout of the remaining units, prior to continuing with Systems Functional Performance Testing of the remaining units.
- H. Coordination and Scheduling: The Contractor shall provide a minimum of 7 days' notice to the Commissioning Agent and the VA regarding the completion schedule for the Pre-Functional Checklists and startup of all equipment and systems. The Commissioning Agent will schedule Systems Functional Performance Tests with the Contractor and VA. The Commissioning Agent will witness and document the Systems Functional Performance Testing of systems. The Contractor shall execute the tests in accordance with the Systems Functional Performance Test Procedure.
- I. Testing Prerequisites: In general, Systems Functional Performance Testing will be conducted only after Pre-Functional Checklists have been satisfactorily completed. The control system shall be sufficiently tested and approved by the Commissioning Agent and the VA before it is used to verify performance of other components or systems. The air balancing and water balancing shall be completed before Systems Functional Performance Testing of air-related or water-related equipment or systems are scheduled. Systems Functional Performance Testing will proceed from components to subsystems to systems. When the proper performance of all interacting individual systems has been

achieved, the interface or coordinated responses between systems will be checked.

- J. Problem Solving: The Commissioning Agent will recommend solutions to problems found, however the burden of responsibility to solve, correct and retest problems is with the Contractor.

### **3.7 DOCUMENTATION, NONCONFORMANCE AND APPROVAL OF TESTS**

- A. Documentation: The Commissioning Agent will witness, and document the results of all Systems Functional Performance Tests using the specific procedural forms developed by the Commissioning Agent for that purpose. Prior to testing, the Commissioning Agent will provide these forms to the VA and the Contractor for review and approval. The Contractor shall include the filled out forms with the O&M manual data.
- B. Nonconformance: The Commissioning Agent will record the results of the Systems Functional Performance Tests on the procedure or test form. All items of nonconformance issues will be noted and reported to the VA on Commissioning Field Reports and/or the Commissioning Master Issues Log.
  - 1. Corrections of minor items of noncompliance identified may be made during the tests. In such cases, the item of noncompliance and resolution shall be documented on the Systems Functional Test Procedure.
  - 2. Every effort shall be made to expedite the systems functional Performance Testing process and minimize unnecessary delays, while not compromising the integrity of the procedures. However, the Commissioning Agent shall not be pressured into overlooking noncompliant work or loosening acceptance criteria to satisfy scheduling or cost issues, unless there is an overriding reason to do so by direction from the VA.
  - 3. As the Systems Functional Performance Tests progresses and an item of noncompliance is identified, the Commissioning Agent shall discuss the issue with the Contractor and the VA.
  - 4. When there is no dispute on an item of noncompliance, and the Contractor accepts responsibility to correct it:
    - a. The Commissioning Agent will document the item of noncompliance and the Contractor's response and/or intentions. The Systems Functional Performance Test then continues or proceeds to another test or sequence. After the day's work is complete, the Commissioning Agent will submit a Commissioning Field Report to the VA. The Commissioning Agent will also note items of

noncompliance and the Contractor's response in the Master Commissioning Issues Log. The Contractor shall correct the item of noncompliance and report completion to the VA and the Commissioning Agent.

- b. The need for retesting will be determined by the Commissioning Agent. If retesting is required, the Commissioning Agent and the Contractor shall reschedule the test and the test shall be repeated.
5. If there is a dispute about item of noncompliance, regarding whether it is an item of noncompliance, or who is responsible:
- a. The item of noncompliance shall be documented on the test form with the Contractor's response. The item of noncompliance with the Contractor's response shall also be reported on a Commissioning Field Report and on the Master Commissioning Issues Log.
  - b. Resolutions shall be made at the lowest management level possible. Other parties are brought into the discussions as needed. Final interpretive and acceptance authority is with the Department of Veterans Affairs.
  - c. The Commissioning Agent will document the resolution process.
  - d. Once the interpretation and resolution have been decided, the Contractor shall correct the item of noncompliance, report it to the Commissioning Agent. The requirement for retesting will be determined by the Commissioning Agent. If retesting is required, the Commissioning Agent and the Contractor shall reschedule the test. Retesting shall be repeated until satisfactory performance is achieved.
- C. Cost of Retesting: The cost to retest a System Functional Performance Test shall be solely the responsibility of the Contractor. Any required retesting by the Contractor shall not be considered a justified reason for a claim of delay or for a time extension by the Contractor.
- D. Failure Due to Manufacturer Defect: If 10%, or three, whichever is greater, of identical pieces (size alone does not constitute a difference) of equipment fail to perform in compliance with the Contract Documents (mechanically or substantively) due to manufacturing

defect, not allowing it to meet its submitted performance specifications, all identical units may be considered unacceptable by the VA. In such case, the Contractor shall provide the VA with the following:

1. Within one week of notification from the VA, the Contractor shall examine all other identical units making a record of the findings. The findings shall be provided to the VA within two weeks of the original notice.
  2. Within two weeks of the original notification, the Contractor shall provide a signed and dated, written explanation of the problem, cause of failures, etc. and all proposed solutions which shall include full equipment submittals. The proposed solutions shall not significantly exceed the specification requirements of the original installation.
  3. The VA shall determine whether a replacement of all identical units or a repair is acceptable.
  4. Two examples of the proposed solution shall be installed by the Contractor and the VA shall be allowed to test the installations for up to one week, upon which the VA will decide whether to accept the solution.
  5. Upon acceptance, the Contractor shall replace or repair all identical items, at their expense and extend the warranty accordingly, if the original equipment warranty had begun. The replacement/repair work shall proceed with reasonable speed beginning within one week from when parts can be obtained.
- E. Approval: The Commissioning Agent will note each satisfactorily demonstrated function on the test form. Formal approval of the Systems Functional Performance Test shall be made later after review by the Commissioning Agent and by the VA. The Commissioning Agent will evaluate each test and report to the VA using a standard form. The VA will give final approval on each test using the same form, and provide signed copies to the Commissioning Agent and the Contractor.

### **3.8 DEFERRED TESTING**

- A. Unforeseen Deferred Systems Functional Performance Tests: If any Systems Functional Performance Test cannot be completed due to the building structure, required occupancy condition or other conditions, execution of the Systems Functional Performance Testing may be delayed upon approval of the VA. These Systems Functional Performance Tests



shall be conducted in the same manner as the seasonal tests as soon as possible. Services of the Contractor to conduct these unforeseen Deferred Systems Functional Performance Tests shall be negotiated between the VA and the Contractor.

- B. Deferred Seasonal Testing: Deferred Seasonal Systems Functional Performance Tests are those that must be deferred until weather conditions are closer to the systems design parameters. The Commissioning Agent will review systems parameters and recommend which Systems Functional Performance Tests should be deferred until weather conditions more closely match systems parameters. The Contractor shall review and comment on the proposed schedule for Deferred Seasonal Testing. The VA will review and approve the schedule for Deferred Seasonal Testing. Deferred Seasonal Systems Functional Performances Tests shall be witnessed and documented by the Commissioning Agent. Deferred Seasonal Systems Functional Performance Tests shall be executed by the Contractor in accordance with these specifications.

### **3.9 OPERATION AND MAINTENANCE TRAINING REQUIREMENTS**

- A. Training Preparation Conference: Before operation and maintenance training, the Commissioning Agent will convene a training preparation conference to include VA's Resident Engineer, VA's Operations and Maintenance personnel, and the Contractor. The purpose of this conference will be to discuss and plan for Training and Demonstration of VA Operations and Maintenance personnel.
- B. The Contractor shall provide training and demonstration as required by other Division 21, Division 22, Division 23, Division 26, Division 27, Division 28, and Division 31 sections. The Training and Demonstration shall include, but is not limited to, the following:
1. Review the Contract Documents.
  2. Review installed systems, subsystems, and equipment.
  3. Review instructor qualifications.
  4. Review instructional methods and procedures.
  5. Review training module outlines and contents.
  6. Review course materials (including operation and maintenance manuals).
  7. Review and discuss locations and other facilities required for instruction.

8. Review and finalize training schedule and verify availability of educational materials, instructors, audiovisual equipment, and facilities needed to avoid delays.
  9. For instruction that must occur outside, review weather and forecasted weather conditions and procedures to follow if conditions are unfavorable.
- C. Training Module Submittals: The Contractor shall submit the following information to the VA and the Commissioning Agent:
1. Instruction Program: Submit two copies of outline of instructional program for demonstration and training, including a schedule of proposed dates, times, length of instruction time, and instructors' names for each training module. Include learning objective and outline for each training module. At completion of training, submit two complete training manuals for VA's use.
  2. Qualification Data: Submit qualifications for facilitator and/or instructor.
  3. Attendance Record: For each training module, submit list of participants and length of instruction time.
  4. Evaluations: For each participant and for each training module, submit results and documentation of performance-based test.
  5. Demonstration and Training Recording:
    - a. General: Engage a qualified commercial photographer to record demonstration and training. Record each training module separately. Include classroom instructions and demonstrations, board diagrams, and other visual aids, but not student practice. At beginning of each training module, record each chart containing learning objective and lesson outline.
    - b. Video Format: Provide high quality color DVD color on standard size DVD disks.
    - c. Recording: Mount camera on tripod before starting recording, unless otherwise necessary to show area of demonstration and training. Display continuous running time.
    - d. Narration: Describe scenes on video recording by audio narration by microphone while demonstration and training is recorded. Include description of items being viewed. Describe vantage point, indicating location, direction (by compass point), and elevation or story of construction.

- e. Submit two copies within seven days of end of each training module.
  - 6. Transcript: Prepared on 8-1/2-by-11-inch paper, punched and bound in heavy-duty, 3-ring, vinyl-covered binders. Mark appropriate identification on front and spine of each binder. Include a cover sheet with same label information as the corresponding videotape. Include name of Project and date of videotape on each page.
- D. Quality Assurance:
- 1. Facilitator Qualifications: A firm or individual experienced in training or educating maintenance personnel in a training program similar in content and extent to that indicated for this Project, and whose work has resulted in training or education with a record of successful learning performance.
  - 2. Instructor Qualifications: A factory authorized service representative, complying with requirements in Division 01 Section "Quality Requirements," experienced in operation and maintenance procedures and training.
  - 3. Photographer Qualifications: A professional photographer who is experienced photographing construction projects.
- E. Training Coordination:
- 1. Coordinate instruction schedule with VA's operations. Adjust schedule as required to minimize disrupting VA's operations.
  - 2. Coordinate instructors, including providing notification of dates, times, length of instruction time, and course content.
  - 3. Coordinate content of training modules with content of approved emergency, operation, and maintenance manuals. Do not submit instruction program until operation and maintenance data has been reviewed and approved by the VA.
- F. Instruction Program:
- 1. Program Structure: Develop an instruction program that includes individual training modules for each system and equipment not part of a system, as required by individual Specification Sections, and as follows:
    - a. Fire protection systems, including fire alarm, fire pumps, and fire suppression systems.
    - b. Intrusion detection systems.
    - c. Conveying systems, including elevators, wheelchair lifts, escalators, and automated materials handling systems.

- d. Medical equipment, including medical gas equipment and piping.
  - e. Laboratory equipment, including laboratory air and vacuum equipment and piping.
  - f. Heat generation, including boilers, feedwater equipment, pumps, steam distribution piping, condensate return systems, heating hot water heat exchangers, and heating hot water distribution piping.
  - g. Refrigeration systems, including chillers, cooling towers, condensers, pumps, and distribution piping.
  - h. HVAC systems, including air handling equipment, air distribution systems, and terminal equipment and devices.
  - i. HVAC instrumentation and controls.
  - j. Electrical service and distribution, including switchgear, transformers, switchboards, panelboards, uninterruptible power supplies, and motor controls.
  - k. Packaged engine generators, including synchronizing switchgear/switchboards, and transfer switches.
  - l. Lighting equipment and controls.
  - m. Communication systems, including intercommunication, surveillance, nurse call systems, public address, mass evacuation, voice and data, and entertainment television equipment.
  - n. Site utilities including lift stations, condensate pumping and return systems, and storm water pumping systems.
- G. Training Modules: Develop a learning objective and teaching outline for each module. Include a description of specific skills and knowledge that participants are expected to master. For each module, include instruction for the following:
- 1. Basis of System Design, Operational Requirements, and Criteria:
    - Include the following:
      - a. System, subsystem, and equipment descriptions.
      - b. Performance and design criteria if Contractor is delegated design responsibility.
      - c. Operating standards.
      - d. Regulatory requirements.
      - e. Equipment function.
      - f. Operating characteristics.
      - g. Limiting conditions.
      - H, Performance curves.

2. Documentation: Review the following items in detail:
  - a. Emergency manuals.
  - b. Operations manuals.
  - c. Maintenance manuals.
  - d. Project Record Documents.
  - e. Identification systems.
  - f. Warranties and bonds.
  - g. Maintenance service agreements and similar continuing commitments.
3. Emergencies: Include the following, as applicable:
  - a. Instructions on meaning of warnings, trouble indications, and error messages.
  - b. Instructions on stopping.
  - c. Shutdown instructions for each type of emergency.
  - d. Operating instructions for conditions outside of normal operating limits.
  - e. Sequences for electric or electronic systems.
  - f. Special operating instructions and procedures.
4. Operations: Include the following, as applicable:
  - a. Startup procedures.
  - b. Equipment or system break-in procedures.
  - c. Routine and normal operating instructions.
  - d. Regulation and control procedures.
  - e. Control sequences.
  - f. Safety procedures.
  - g. Instructions on stopping.
  - h. Normal shutdown instructions.
  - i. Operating procedures for emergencies.
  - j. Operating procedures for system, subsystem, or equipment failure.
  - k. Seasonal and weekend operating instructions.
  - l. Required sequences for electric or electronic systems.
  - m. Special operating instructions and procedures.
5. Adjustments: Include the following:
  - a. Alignments.
  - b. Checking adjustments.
  - c. Noise and vibration adjustments.
  - d. Economy and efficiency adjustments.
6. Troubleshooting: Include the following:

- a. Diagnostic instructions.
  - b. Test and inspection procedures.
- 7. Maintenance: Include the following:
  - a. Inspection procedures.
  - b. Types of cleaning agents to be used and methods of cleaning.
  - c. List of cleaning agents and methods of cleaning detrimental to product.
  - d. Procedures for routine cleaning
  - e. Procedures for preventive maintenance.
  - f. Procedures for routine maintenance.
  - g. Instruction on use of special tools.
- 8. Repairs: Include the following:
  - a. Diagnosis instructions.
  - b. Repair instructions.
  - c. Disassembly; component removal, repair, and replacement; and reassembly instructions.
  - d. Instructions for identifying parts and components.
  - e. Review of spare parts needed for operation and maintenance.
- H. Training Execution:
  - 1. Preparation: Assemble educational materials necessary for instruction, including documentation and training module. Assemble training modules into a combined training manual. Set up instructional equipment at instruction location.
  - 2. Instruction:
    - a. Facilitator: Engage a qualified facilitator to prepare instruction program and training modules, to coordinate instructors, and to coordinate between Contractor and Department of Veterans Affairs for number of participants, instruction times, and location.
    - b. Instructor: Engage qualified instructors to instruct VA's personnel to adjust, operate, and maintain systems, subsystems, and equipment not part of a system.
      - 1) The Commissioning Agent will furnish an instructor to describe basis of system design, operational requirements, criteria, and regulatory requirements.
      - 2) The VA will furnish an instructor to describe VA's operational philosophy.

- 3) The VA will furnish the Contractor with names and positions of participants.
  3. Scheduling: Provide instruction at mutually agreed times. For equipment that requires seasonal operation, provide similar instruction at start of each season. Schedule training with the VA and the Commissioning Agent with at least seven days' advance notice.
  4. Evaluation: At conclusion of each training module, assess and document each participant's mastery of module by use of an oral, or a written, performance-based test.
  5. Cleanup: Collect used and leftover educational materials and remove from Project site. Remove instructional equipment. Restore systems and equipment to condition existing before initial training use.
- I. Demonstration and Training Recording:
1. General: Engage a qualified commercial photographer to record demonstration and training. Record each training module separately. Include classroom instructions and demonstrations, board diagrams, and other visual aids, but not student practice. At beginning of each training module, record each chart containing learning objective and lesson outline.
  2. Video Format: Provide high quality color DVD color on standard size DVD disks.
  3. Recording: Mount camera on tripod before starting recording, unless otherwise necessary to show area of demonstration and training. Display continuous running time.
  4. Narration: Describe scenes on videotape by audio narration by microphone while demonstration and training is recorded. Include description of items being viewed. Describe vantage point, indicating location, direction (by compass point), and elevation or story of construction.

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SECTION 02 41 00

DEMOLITION

PART 1 - GENERAL

1.1 DESCRIPTION:

- A. This section specifies demolition and removal of buildings, portions of buildings, utilities, other structures and debris from trash dumps shown.

1.2 RELATED WORK:

- A. Safety Requirements: GENERAL CONDITIONS Article, ACCIDENT PREVENTION.
- B. Disconnecting utility services prior to demolition: Section 010000, GENERAL REQUIREMENTS.
- C. Reserved items that are to remain the property of the Government: Section 01 00 00, GENERAL REQUIREMENTS.
- D. Asbestos Removal: Section 02 82 11, TRADITIONAL ASBESTOS ABATEMENT.
- E. Lead Paint: Section 02 83 33.13, LEAD-BASED PAINT REMOVAL AND DISPOSAL.
- F. Environmental Protection: Section 01 57 19, TEMPORARY ENVIRONMENTAL CONTROLS.
- G. Construction Waste Management: Section 01 74 19 CONSTRUCTION WASTE MANAGEMENT.
- H. Infectious Control: Section 01 00 00, GENERAL REQUIREMENTS, Article 1.7, INFECTION PREVENTION MEASURES.

1.3 PROTECTION:

- A. Perform demolition in such manner as to eliminate hazards to persons and property; to minimize interference with use of adjacent areas, utilities and structures or interruption of use of such utilities; and to provide free passage to and from such adjacent areas of structures. Comply with requirements of GENERAL CONDITIONS Article, ACCIDENT PREVENTION.
- B. Provide safeguards, including warning signs, barricades, temporary fences, warning lights, and other similar items that are required for protection of all personnel during demolition and removal operations. Comply with requirements of Section 01 00 00, GENERAL REQUIREMENTS, Article PROTECTION OF EXISTING VEGETATION, STRUCTURES, EQUIPMENT, UTILITIES AND IMPROVEMENTS.
- C. Provide enclosed dust chutes with control gates from each floor to

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carry debris to truck beds and govern flow of material into truck. Provide overhead bridges of tight board or prefabricated metal construction at dust chutes to protect persons and property from falling debris.

- D. Prevent spread of flying particles and dust. Sprinkle rubbish and debris with water to keep dust to a minimum. Do not use water if it results in hazardous or objectionable condition such as, but not limited to; ice, flooding, or pollution. Vacuum and dust the work area daily.
- E. In addition to previously listed fire and safety rules to be observed in performance of work, include following:
  - 1. No wall or part of wall shall be permitted to fall outwardly from structures.
  - 2. Maintain at least one stairway in each structure in usable condition to highest remaining floor. Keep stairway free of obstructions and debris until that level of structure has been removed.
  - 3. Wherever a cutting torch or other equipment that might cause a fire is used, provide and maintain fire extinguishers nearby ready for immediate use. Instruct all possible users in use of fire extinguishers.
  - 4. Keep hydrants clear and accessible at all times. Prohibit debris from accumulating within a radius of 4500 mm (15 feet) of fire hydrants.
- F. Before beginning any demolition work, the Contractor shall survey the site and examine the drawings and specifications to determine the extent of the work. The contractor shall take necessary precautions to avoid damages to existing items to remain in place, to be reused, or to remain the property of the Medical Center; any damaged items shall be repaired or replaced as approved by the Resident Engineer. The Contractor shall coordinate the work of this section with all other work and shall construct and maintain shoring, bracing, and supports as required. The Contractor shall ensure that structural elements are not overloaded and shall be responsible for increasing structural supports or adding new supports as may be required as a result of any cutting, removal, or demolition work performed under this contract. Do not overload structural elements. Provide new supports and

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reinforcement for existing construction weakened by demolition or removal works. Repairs, reinforcement, or structural replacement must have Resident Engineer's approval.

G. The work shall comply with the requirements of Section 01 57 19, TEMPORARY ENVIRONMENTAL CONTROLS.

H. The work shall comply with the requirements of Section 01 00 00, GENERAL REQUIREMENTS, Article 1.7 INFECTION PREVENTION MEASURES.

**1.4 UTILITY SERVICES:**

A. Demolish and remove outside utility service lines shown to be removed.

B. Remove abandoned outside utility lines that would interfere with installation of new utility lines and new construction.

**PART 2 - PRODUCTS (NOT USED)**

**PART 3 - EXECUTION**

**3.1 DEMOLITION:**

A. Debris, including brick, concrete, stone, metals and similar materials shall become property of Contractor and shall be disposed of by him daily, off the Medical Center to avoid accumulation at the demolition site. Materials that cannot be removed daily shall be stored in areas specified by the Resident Engineer. Contractor shall dispose debris in compliance with applicable federal, state or local permits, rules and/or regulations.

B. Remove existing utilities as indicated or uncovered by work and terminate in a manner conforming to the nationally recognized code covering the specific utility and approved by the Resident Engineer. When Utility lines are encountered that are not indicated on the drawings, the Resident Engineer shall be notified prior to further work in that area.

**3.2 CLEAN-UP:**

A. On completion of work of this section and after removal of all debris, leave site in clean condition satisfactory to Resident Engineer. Clean-up shall include off the Medical Center disposal of all items and materials not required to remain property of the Government as well as all debris and rubbish resulting from demolition operations.

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SECTION 02 82 11  
TRADITIONAL ASBESTOS ABATEMENT

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**PART 1 - GENERAL**

**1.1 SUMMARY OF THE WORK**

**1.1.1 CONTRACT DOCUMENTS AND RELATED REQUIREMENTS**

Drawings, general provisions of the contract, including general and supplementary conditions and other Division 01 specifications, shall apply to the work of this section. The contract documents show the work to be done under the contract and related requirements and conditions impacting the project. Related requirements and conditions include applicable codes and regulations, notices and permits, existing site conditions and restrictions on use of the site, requirements for partial owner occupancy during the work, coordination with other work and the phasing of the work. In the event the Asbestos Abatement Contractor discovers a conflict in the contract documents and/or requirements or codes, the conflict must be brought to the immediate attention of the Contracting Officer for resolution. Whenever there is a conflict or overlap in the requirements, the most stringent shall apply. Any actions taken by the Contractor without obtaining guidance from the Contracting Officer shall become the sole risk and responsibility of the Asbestos Abatement Contractor. All costs incurred due to such action are also the responsibility of the Asbestos Abatement Contractor.

**1.1.2 EXTENT OF WORK**

- A. Below is a brief description of the estimated quantities of asbestos containing materials to be abated. These quantities are for informational purposes only and are based on the best information available at the time of the specification preparation. The Contractor shall satisfy himself as the actual quantities to be abated. Nothing in this section may be interpreted as limiting the extent of work otherwise required by this contract and related documents.
- B. The majority of the ninth (9th) floor is undergoing a renovation. As part of that renovation there are areas on the 8<sup>th</sup> and 10<sup>th</sup> floors that will also be renovated. The areas on the 8<sup>th</sup> floor include the domestic water pipes that will be relocated to accommodate the new bathrooms on the 9<sup>th</sup> floor. The areas on the 10<sup>th</sup> floor include the core areas including the two (2) eastern most dumbwaiters. Additionally, the two (2) eastern most dumbwaiter doors on the 8<sup>th</sup> and 9<sup>th</sup> floors shall also be removed. Asbestos-containing materials (ACM's) must be removed to allow for the renovation. ACM's include but are not limited to pipe insulation, pipe fitting insulation, floor tile, mastic, and dumbwaiter door insulation. There are areas where ceiling plaster, wall plaster, and masonry will be removed and disposed of as ACM because it is contaminated with thermal system ACM (Please see specification for locations).
- C. The contractor shall construct personal and waste decontamination units outside the work areas for use in asbestos abatement. The decontamination units shall be located contiguous to the 10<sup>th</sup> floor work areas and remote from the 8<sup>th</sup> and 9<sup>th</sup> floor work areas.
- D. Scheduling of work shall be coordinated with the V.A. because domestic water systems may have to be shut down to perform the work. The asbestos abatement shall be coordinated to avoid interruptions to the normal activities of the V.A.
- E. The contractor shall prepare the 10th floor work areas for full containment abatement in accordance with this specification and

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- applicable codes, rules and regulations. This includes two (2) layers of 6-mil plastic sheeting over all isolation barriers, two (2) layers of 6-mil plastic sheeting over all critical barriers and two (2) layers of 6-mil plastic sheeting on all walls, floors and ceilings. The 8<sup>th</sup> and 9<sup>th</sup> floor work areas shall be performed using HEPA-filtered negative air pressure tent enclosures with glovebags. Coordinate the exact location of the pipe insulation removal with the mechanical contractor for the plumbing "tie-ins".
- F. The contractor shall erect isolation barriers that separate the work areas from the remainder of the building. The barriers shall be constructed of a fire retardant sheathing material of at least 5/8" thickness on the work side of the studs. The isolation barrier shall be plasticized with two (2) layers of 6-mil fire retardant plastic sheeting. The isolation barriers shall be caulked at the sheathing seams and where the sheathing meets the floor, walls and ceiling. The isolation barrier shall be constructed using fire retardant 2"x4" framing, 16 inches center-to-center, and caulked at all seams. All utilities and piping shall be locked out and tagged before the contractor is to begin abatement activities.
- G. Following completion of the work area preparation, the contractor shall remove all wall/ceiling plaster, and masonry wet as ACM to access the underlying pipe and fitting insulation. Two (2) layers of 6-mil plastic sheeting shall be attached to the wall and ceiling around the pipe and fitting insulation to be removed. Following isolation around the pipes, the contractor shall remove the pipe and fitting insulation, followed by the floor tile and mastic. The contractor shall also remove any debris as ACM that is present or created by the wall/ceiling plaster, and masonry demolition. The asbestos abatement contractor is to coordinate the removal of the dumbwaiter doors with the general contractor so that the dumbwaiter shaft is not left open for excessive periods of time due to fire barrier requirements.
- H. Following the abatement of friable ACM's (wall/ceiling plaster, masonry and pipe/fitting insulation), the contractor shall remove the two (2) layers of 6-mil plastic sheeting from the floor specified to be removed. The floor plastic shall be double bagged and disposed of as asbestos-contaminated waste. The floor tile and mastic shall be abated and disposed of as asbestos-containing material. Leave floor plastic in areas where the floor tile and mastic are not specified to be abated until all other ACM has been abated.
- I. Remove all domestic hot and cold water pipe insulation as well as steam pipe insulation on the 8<sup>th</sup> and 10<sup>th</sup> floors through the concrete slabs where specified to be removed. Coordinate exact location of removals with mechanical contractor.
- J. All asbestos-containing materials within the contract limits must be removed and disposed of as asbestos-contaminated waste unless specifically excluded in these specifications or on the drawings.
- K. All ACM's shall be removed in accordance with New York State Department of Labor (NYSDOL) Industrial Code Rule 56 (12 NYCRR 56) and applicable Federal OSHA and EPA regulations. Where there is an overlap the most stringent regulation shall apply.
- L. The black iron supporting the ceiling plaster and drop ceilings is to remain intact throughout asbestos abatement activities.
- M. All work area decontamination units (personal and waste) shall be fully framed and sheathed because they will be located in areas of public access.

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- N. All utilities, mechanical systems and piping shall be locked out and tagged before the contractor is to begin abatement activities.
- O. Removal and disposal of asbestos-containing materials (ACM) and asbestos contaminated elements (ACE) is present in the following approximate quantities:

LOCATION	MATERIAL	QUANTITY
Room 8109C	Pipe Insulation	15 L.F. 4-8" 10 Fittings 4-8"
Room 8109C	Contaminated Wall Plaster, Ceiling Plaster and Masonry	40 S.F.
8 <sup>th</sup> , 9 <sup>th</sup> and 10 <sup>th</sup> Floor Core Areas	Dumbwaiter Doors-Top and Bottom	2 Each
Room 8104S	Pipe Insulation	15 L.F. 4-8" 10 Fittings 4-8"
Room 8104S	Contaminated Wall Plaster, Ceiling Plaster and Masonry	40 S.F.
Room 8099S	Pipe Insulation	15 L.F. 4-8" 10 Fittings 4-8"
Room 8099S	Contaminated Wall Plaster, Ceiling Plaster and Masonry	40 S.F.
Room 8098S	Pipe Insulation	15 L.F. 4-8" 10 Fittings 4-8"
Room 8098S	Contaminated Wall Plaster, Ceiling Plaster and Masonry	40 S.F.
Room 8090S	Pipe Insulation	15 L.F. 4-8" 10 Fittings 4-8"
Room 8090S	Contaminated Wall Plaster, Ceiling Plaster and Masonry	40 S.F.
Room 8096S	Pipe Insulation	15 L.F. 4-8" 10 Fittings 4-8"
Room 8096S	Contaminated Wall Plaster, Ceiling Plaster and Masonry	40 S.F.
Room 8086S	Pipe Insulation	15 L.F. 4-8" 10 Fittings 4-8"
Room 8086S	Contaminated Wall Plaster, Ceiling Plaster and Masonry	40 S.F.
Room 8084S	Pipe Insulation	15 L.F. 4-8" 10 Fittings 4-8"
Room 8084S	Contaminated Wall Plaster, Ceiling Plaster and Masonry	40 S.F.
Room 8083S	Pipe Insulation	15 L.F. 4-8" 10 Fittings 4-8"
Room 8083S	Contaminated Wall Plaster, Ceiling Plaster and Masonry	40 S.F.
Room 8077S	Pipe Insulation	15 L.F. 4-8" 10 Fittings 4-8"
Room 8077S	Contaminated Wall Plaster, Ceiling Plaster and Masonry	40 S.F.
Room 8060S	Pipe Insulation	15 L.F. 4-8" 10 Fittings 4-8"
Room 8060S	Contaminated Wall Plaster, Ceiling Plaster and Masonry	40 S.F.
Room 8061S	Pipe Insulation	15 L.F. 4-8"

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		10 Fittings 4-8"
Room 8061S	Contaminated Wall Plaster, Ceiling Plaster and Masonry	40 S.F.
Room 10108C	Pipe Insulation	50 L.F. 4-8" 15 Fittings 4-8"
Room 10108C	Contaminated Wall Plaster, Ceiling Plaster and Masonry	50 S.F.
Room 10108C	Floor Tile and Mastic (Multiple Layers)	135 S.F.
Room 10109C	Floor Tile and Mastic (Multiple Layers)	60 S.F.
Room 10111C	Pipe Insulation	80 L.F. 4-8" 25 Fittings 4-8"
Room 10111C	Contaminated Wall Plaster, Ceiling Plaster and Masonry	80 S.F.
Room 10111C	Floor Tile and Mastic (Multiple Layers)	170 S.F.
Room 10111AC	Pipe Insulation	80 L.F. 4-8" 25 Fittings 4-8"
Room 10111AC	Contaminated Wall Plaster, Ceiling Plaster and Masonry	80 S.F.
Room 10111AC	Floor Tile and Mastic (Multiple Layers)	140 S.F.

1.1.3 RELATED WORK

- A. Section 07 84 00, FIRESTOPPING.
- B. Section 02 41 00, DEMOLITION.
- C. Division 09, FINISHES
- D. Division 22, PLUMBING.
- E. Section 21 05 11, COMMON WORK RESULTS FOR FIRE SUPPRESSION / Section 22 05 11, COMMON WORK RESULTS FOR PLUMBING / Section 23 05 11, COMMON WORK RESULTS FOR HVAC AND STEAM GENERATION.
- F. Section 21 05 11, COMMON WORK RESULTS FOR FIRE SUPPRESSION / Section 22 05 11, COMMON WORK RESULTS FOR PLUMBING / Section 23 05 11, COMMON WORK RESULTS FOR HVAC AND STEAM GENERATION
- G. Section 23 07 11, HVAC, PLUMBING, AND BOILER PLANT INSULATION.
- H. Section 22 05 19, METERS AND GAGES FOR PLUMBING PIPING / Section 22 05 23, GENERAL-DUTY VALVES FOR PLUMBING PIPING / Section 22 05 33, HEAT TRACING FOR PLUMBING PIPING / Section 22 11 00, FACILITY WATER DISTRIBUTION / Section 22 13 00, FACILITY SANITARY SEWERAGE / Section 22 13 23, SANITARY WASTE INTERCEPTORS / Section 22 14 00, FACILITY STORM DRAINAGE / Section 22 66 00, CHEMICAL-WASTE SYSTEMS FOR LABORATORY AND HEALTHCARE FACILITIES / Section 23 11 23, FACILITY NATURAL-GAS PIPING.
- I. Section 23 21 13, HYDRONIC PIPING / Section 23 22 13, STEAM AND CONDENSATE HEATING PIPING.
- J. Section 23 31 00, HVAC DUCTS AND CASINGS / Section 23 37 00, AIR OUTLETS AND INLETS.

1.1.4 TASKS

The work tasks are summarized briefly as follows:

- A. Pre-abatement activities including pre-abatement meeting(s), inspection(s), notifications, permits, submittal approvals, regulated area preparations, emergency procedures arrangements, and standard operating procedures for asbestos abatement work.

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- B. Abatement activities including removal, encapsulation, clean-up and disposal of ACM waste, recordkeeping, security, monitoring, and inspections.
  - C. Cleaning and decontamination activities including final visual inspection, air monitoring and certification of decontamination.
- 1.1.5 CONTRACTORS USE OF PREMISES
- A. The Contractor and Contractor's personnel shall cooperate fully with the VA consultant to facilitate efficient use of buildings and areas within buildings. The Contractor shall perform the work in accordance with the VA specifications, drawings, phasing plan and in compliance with all applicable Federal, State and Local regulations and requirements.
  - B. The Contractor shall use the existing facilities in the building strictly within the limits indicated in contract documents as well as the approved pre-abatement work plan. Asbestos abatement drawings of partially occupied buildings will show the limits of regulated areas; the placement of decontamination facilities; the temporary location of bagged waste ACM; the path of transport to outside the building; and the temporary waste storage area for each regulated area. Any variation from the arrangements shown on drawings shall be secured in writing from the VA representative through the pre-abatement plan of action. The following limitations of use shall apply to existing facilities shown on drawings: The contractor shall limit his work to the areas shown on the accompanying drawings and listed in this specification.

1.2 VARIATIONS IN QUANTITY

The quantities and locations of ACM as indicated on the drawings and the extent of work included in this section are estimated which are limited by the physical constraints imposed by occupancy of the buildings. Accordingly, minor variations (+/- 5%) in quantities of ACM within the regulated area are considered as having no impact on contract price and time requirements of this contract. Where additional work is required beyond the above variation, the contractor shall provide unit prices for newly discovered materials and those prices shall be used for additional work required under the contractor.

1.3 STOP ASBESTOS REMOVAL

If the Contracting Officer; their field representative; or the VPIH/CIH presents a written **Stop Asbestos Removal Order**, the Contractor/Personnel shall immediately stop all asbestos removal and maintain HEPA filtered air flow and adequately wet any exposed ACM. The Contractor shall not resume any asbestos removal activity until authorized to do so by the VA. A stop asbestos removal order may be issued at any time the VA determines abatement conditions/activities are not within specification requirements. Work stoppage will continue until conditions have been corrected to the satisfaction of the VA. Standby time and costs for corrective actions will be borne by the Contractor, including the industrial hygienist's time. The occurrence of any of the following events shall be reported immediately by the Contractor's competent person in writing to the VA representative and shall require the Contractor to immediately stop asbestos removal/disturbance activities and initiate fiber reduction activities:

- A.  $\geq 0.01$  f/cc outside a regulated area or  $>0.05$  f/cc inside a regulated area;
- B. breach/break in regulated area isolation barrier(s);
- C. less than  $-0.02$ " WCG pressure in the regulated area;

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- D. serious injury/death at the site ;
- E. fire/safety emergency at the site ;
- F. respiratory protection system failure;
- G. power failure or loss of wetting agent; or
- H. any visible emissions observed outside the regulated area.

**1.4 DEFINITIONS**

**1.4.1 GENERAL**

Definitions and explanations here are neither complete nor exclusive of all terms used in the contract documents, but are general for the work to the extent they are not stated more explicitly in another element of the contract documents. Drawings must be recognized as diagrammatic in nature and not completely descriptive of the requirements indicated therein.

**1.4.2 GLOSSARY**

**Abatement** - Procedures to control fiber release from asbestos-containing materials, typically during removal. Includes removal, encapsulation, enclosure, demolition and renovation activities related to asbestos.

**ACE** - Asbestos contaminated elements.

**ACM** - Asbestos containing material.

**Aerosol** - Solid or liquid particulate suspended in air.

**Adequately wet** - Sufficiently mixed or penetrated with liquid to prevent the release of particulates. If visible emissions are observed coming from the ACM, then that material has not been adequately wetted.

**Aggressive method** - Removal or disturbance of building material by sanding, abrading, grinding, or other method that breaks, crumbles, or disintegrates intact ACM.

**Aggressive sampling** - EPA AHERA defined clearance sampling method using air moving equipment such as fans and leaf blowers to aggressively disturb and maintain in the air residual fibers after abatement.

**AHERA** - Asbestos Hazard Emergency Response Act. Asbestos regulations for schools issued in 1987.

**Aircell** - Pipe or duct insulation made of corrugated cardboard which contains asbestos.

**Air monitoring** - The process of measuring the fiber content of a known volume of air collected over a specified period of time. The NIOSH 7400 Method, Issue 2 is used to determine the fiber levels in air.

**Air sample filter** - The filter used to collect fibers which are then counted. The filter is made of mixed cellulose ester membrane for PCM (Phase Contrast Microscopy) and polycarbonate for TEM (Transmission Electron Microscopy)

**Amended water** - Water to which a surfactant (wetting agent) has been added to increase the penetrating ability of the liquid.

**Asbestos** - Includes chrysotile, amosite, crocidolite, tremolite asbestos, anthophyllite asbestos, actinolite asbestos, and any of these minerals that have been chemically treated or altered. Asbestos also includes PACM, as defined below.

**Asbestos-containing material (ACM)** - Any material containing more than one percent of asbestos.

**Asbestos contaminated elements (ACE)** - Building elements such as ceilings, walls, lights, or ductwork that are contaminated with asbestos.

**Asbestos-containing waste material** - Asbestos-containing material or asbestos contaminated objects requiring disposal.

**Asbestos waste decontamination facility** - A system consisting of drum/bag washing facilities and a temporary storage area for cleaned containers of

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asbestos waste. Used as the exit for waste and equipment leaving the regulated area. In an emergency, it may be used to evacuate personnel.

**Authorized person** - Any person authorized by the VA, the Contractor, or government agency and required by work duties to be present in regulated areas.

**Authorized visitor** - Any person approved by the VA; the contractor; or any government agency having jurisdiction over the regulated area.

**Barrier** - Any surface that isolates the regulated area and inhibits fiber migration from the regulated area.

**Containment Barrier** - An airtight barrier consisting of walls, floors, and/or ceilings of sealed plastic sheeting which surrounds and seals the outer perimeter of the regulated area.

**Critical Barrier** - The barrier responsible for isolating the regulated area from adjacent spaces, typically constructed of plastic sheeting secured in place at openings such as doors, windows, or any other opening into the regulated area.

**Primary Barrier** - Barriers placed over critical barriers and exposed directly to abatement work.

**Secondary Barrier** - Any additional sheeting used to isolate and provide protection from debris during abatement work.

**Breathing zone** - The hemisphere forward of the shoulders with a radius of about 150 - 225 mm (6 - 9 inches) from the worker's nose.

**Bridging encapsulant** - An encapsulant that forms a layer on the surface of the ACM.

**Building/facility owner** - The legal entity, including a lessee, which exercises control over management and recordkeeping functions relating to a building and/or facility in which asbestos activities take place.

**Bulk testing** - The collection and analysis of suspect asbestos containing materials.

**Certified Industrial Hygienist (CIH)** - One certified in practice of industrial hygiene by the American Board of Industrial Hygiene. An industrial hygienist Certified in Comprehensive Practice by the American Board of Industrial Hygiene.

**Class I asbestos work** - Activities involving the removal of Thermal System Insulation (TSI) and surfacing ACM and Presumed Asbestos Containing Material (PACM).

**Class II asbestos work** - Activities involving the removal of ACM which is not thermal system insulation or surfacing material. This includes, but is not limited to, the removal of asbestos-containing wallboard, floor tile and sheeting, roofing and siding shingles, and construction mastic.

**Clean room/Changing room** - An uncontaminated room having facilities for the storage of employee's street clothing and uncontaminated materials and equipment.

**Clearance sample** - The final air sample taken after all asbestos work has been done and visually inspected. Performed by the VA's industrial hygiene consultant (VPIH/CIH).

**Closely resemble** - The major workplace conditions which have contributed to the levels of historic asbestos exposure, are no more protective than conditions of the current workplace.

**Competent person** - In addition to the definition in 29 CFR 1926.32(f), one who is capable of identifying existing asbestos hazards in the workplace and selecting the appropriate control strategy for asbestos exposure, who has the authority to take prompt corrective measures to eliminate them, as specified in 29 CFR 1926.32(f); in addition, for

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Class I and II work who is specially trained in a training course which meets the criteria of EPA's Model Accreditation Plan (40 CFR 763) for supervisor.

**Contractor's Professional Industrial Hygienist (CPIH)** - The asbestos abatement contractor's industrial hygienist. The industrial hygienist must meet the qualification requirements of the PIH.

**Count** - Refers to the fiber count or the average number of fibers greater than five microns in length per cubic centimeter of air.

**Decontamination area/unit** - An enclosed area adjacent to and connected to the regulated area and consisting of an equipment room, shower room, and clean room, which is used for the decontamination of workers, materials, and equipment that are contaminated with asbestos.

**Demolition** - The wrecking or taking out of any load-supporting structural member and any related razing, removing, or stripping of asbestos products.

**Disposal bag** - Typically 6 mil thick siftproof, dustproof, leaktight container used to package and transport asbestos waste from regulated areas to the approved landfill. Each bag/container must be labeled/marked in accordance with EPA, OSHA and DOT requirements.

**Disturbance** - Activities that disrupt the matrix of ACM or PACM, crumble or pulverize ACM or PACM, or generate visible debris from ACM or PACM. Disturbance includes cutting away small amounts of ACM or PACM, no greater than the amount that can be contained in one standard sized glove bag or waste bag in order to access a building component. In no event shall the amount of ACM or PACM so disturbed exceed that which can be contained in one glove bag or disposal bag which shall not exceed 60 inches in length or width.

**Drum** - A rigid, impermeable container made of cardboard fiber, plastic, or metal which can be sealed in order to be siftproof, dustproof, and leaktight.

**Employee exposure** - The exposure to airborne asbestos that would occur if the employee were not wearing respiratory protection equipment.

**Encapsulant** - A material that surrounds or embeds asbestos fibers in an adhesive matrix and prevents the release of fibers.

**Encapsulation** - Treating ACM with an encapsulant.

**Enclosure** - The construction of an air tight, impermeable, permanent barrier around ACM to control the release of asbestos fibers from the material and also eliminate access to the material.

**Equipment room** - A contaminated room located within the decontamination area that is supplied with impermeable bags or containers for the disposal of contaminated protective clothing and equipment.

**Fiber** - A particulate form of asbestos, 5 microns or longer, with a length to width ratio of at least 3 to 1.

**Fibers per cubic centimeter (f/cc)** - Abbreviation for fibers per cubic centimeter, used to describe the level of asbestos fibers in air.

**Filter** - Media used in respirators, vacuums, or other machines to remove particulate from air.

**Firestopping** - Material used to close the open parts of a structure in order to prevent a fire from spreading.

**Friable asbestos containing material** - Any material containing more than 1 percent asbestos as determined using the method specified in appendix A, Subpart F, 40 CFR 763, section 1, Polarized Light Microscopy, that, when dry, can be crumbled, pulverized, or reduced to powder by hand pressure.



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**Glovebag** - Not more than a 60 x 60 inch impervious plastic bag-like enclosure affixed around an asbestos-containing material, with glove-like appendages through which materials and tools may be handled.

**High efficiency particulate air (HEPA) filter** - A filter capable of trapping and retaining at least 99.97 percent of all mono-dispersed particles of 0.3 microns or greater in diameter.

**HEPA vacuum** - Vacuum collection equipment equipped with a HEPA filter system capable of collecting and retaining asbestos fibers.

**Homogeneous area** - An area of surfacing, thermal system insulation or miscellaneous ACM that is uniform in color, texture and date of application.

**HVAC** - Heating, Ventilation and Air Conditioning

**Industrial hygienist** - A professional qualified by education, training, and experience to anticipate, recognize, evaluate and develop controls for occupational health hazards. Meets definition requirements of the American Industrial Hygiene Association (AIHA).

**Industrial hygienist technician** - A person working under the direction of an IH or CIH who has special training, experience, certifications and licenses required for the industrial hygiene work assigned.

**Intact** - The ACM has not crumbled, been pulverized, or otherwise deteriorated so that the asbestos is no longer likely to be bound with its matrix.

**Lockdown** - Applying encapsulant, after a final visual inspection, on all abated surfaces at the conclusion of ACM removal prior to removal of critical barriers.

**National Emission Standards for Hazardous Air Pollutants (NESHAP's)** - EPA's rule to control emissions of asbestos to the environment.

**Negative initial exposure assessment** - A demonstration by the employer which complies with the criteria in 29 CFR 1926.1101 (f)(2)(iii), that employee exposure during an operation is expected to be consistently below the PEL's.

**Negative pressure** - Air pressure which is lower than the surrounding area, created by exhausting air from a sealed regulated area through HEPA equipped filtration units. OSHA requires maintaining -0.02" water column gauge inside the negative pressure enclosure.

**Negative pressure respirator** - A respirator in which the air pressure inside the facepiece is negative during inhalation relative to the air outside the respirator.

**Non-friable ACM** - Material that contains more than 1 percent asbestos but cannot be crumbled, pulverized, or reduced to powder by hand pressure.

**Organic vapor cartridge** - The type of cartridge used on air purifying respirators for organic vapor exposures.

**Outside air** - The air outside buildings and structures, including, but not limited to, the air under a bridge or in an open ferry dock.

**Owner/operator** - Any person who owns, leases, operates, controls, or supervises the facility being demolished or renovated or any person who owns, leases, operates, controls, or supervises the demolition or renovation operation, or both.

**Penetrating encapsulant** - Encapsulant that is absorbed into the ACM matrix without leaving a surface layer.

**Personal sampling/monitoring** - Representative air samples obtained in the breathing zone of the person using a cassette and battery operated pump to determine asbestos exposure.

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**Permissible exposure limit (PEL)** - The level of exposure OSHA allows for an 8 hour time weighted average. For asbestos fibers, the PEL is 0.1 fibers per cc.

**Polarized light microscopy (PLM)** - Light microscopy using dispersion staining techniques and refractive indices to identify and quantify the type(s) of asbestos present in a bulk sample.

**Polyethylene sheeting** - Strong plastic barrier material 4 to 6 mils thick, semi-transparent, sometimes flame retardant in compliance with NFPA 241.

**Positive/negative fit check** - A method of verifying the fit of a respirator by closing off the filters and breathing in or closing off the exhalation valve and breathing out while detecting leakage of the respirator.

**Presumed ACM (PACM)** - Thermal system insulation, surfacing, and flooring material installed in buildings prior to 1981. If the building owner has actual knowledge, or should have known through the exercise of due diligence that other materials are ACM, they too must be treated as PACM. The designation of PACM may be rebutted pursuant to 29 CFR 1926.1101 (k)(5).

**Professional IH** - An IH who meets the definition requirements of AIHA; meets the definition requirements of OSHA as a "Competent Person" at 29 CFR 1926.1101 (b); has completed two specialized EPA approved courses on management and supervision of asbestos abatement projects; has formal training in respiratory protection and waste disposal; and has a minimum of four projects of similar complexity with this project of which at least three projects serving as the supervisory IH.

**Project designer** - A person who has successfully completed the training requirements for an asbestos abatement project designer as required by 40 CFR 763 Appendix C, Part I; (B)(5).

**Protection factor** - A value assigned by OSHA/NIOSH to indicate the assigned protection a respirator should provide if worn properly. The number indicates the reduction of exposure level from outside to inside the respirator.

**Qualitative fit test (QLFT)** - A fit test using a challenge material that can be sensed by the wearer if leakage in the respirator occurs.

**Quantitative fit test (QNFT)** - A fit test using a challenge material which is quantified outside and inside the respirator thus allowing the determination of the actual fit factor.

**Regulated area** - An area established by the employer to demarcate where Class I, II, III asbestos work is conducted, and any adjoining area where debris and waste from such asbestos work may accumulate; and a work area within which airborne concentrations of asbestos exceed, or there is a reasonable possibility they may exceed the PEL.

**Regulated ACM (RACM)** - Friable ACM; Category I nonfriable ACM that has become friable; Category I nonfriable ACM that will be or has been subjected to sanding, grinding, cutting, or abrading or; Category II nonfriable ACM that has a high probability of becoming or has become crumbled, pulverized, or reduced to powder by the forces expected to act on the material in the course of the demolition or renovation operation.

**Removal** - All operations where ACM, PACM and/or RACM is taken out or stripped from structures or substrates, including demolition operations.

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**Renovation** - Altering a facility or one or more facility components in any way, including the stripping or removal of asbestos from a facility component which does not involve demolition activity.

**Repair** - Overhauling, rebuilding, reconstructing, or reconditioning of structures or substrates, including encapsulation or other repair of ACM or PACM attached to structures or substrates.

**Shower room** - The portion of the PDF where personnel shower before leaving the regulated area. Also used for bag/drum decontamination in the EDF.

**Standard operating procedures (SOP's)** - Asbestos work procedures required to be submitted by the contractor before work begins.

**Supplied air respirator (SAR)** - A respirator that utilizes an air supply separate from the air in the regulated area.

**Surfacing ACM** - A material containing more than 1 percent asbestos that is sprayed, troweled on or otherwise applied to surfaces for acoustical, fireproofing and other purposes.

**Surfactant** - A chemical added to water to decrease water's surface tension thus making it more penetrating into ACM.

**Thermal system ACM** - A material containing more than 1 percent asbestos applied to pipes, fittings, boilers, breeching, tanks, ducts, or other structural components to prevent heat loss or gain.

**Transmission electron microscopy (TEM)** - A microscopy method that can identify and count asbestos fibers.

**VA Industrial Hygienist (VPIH)** - Department of Veterans Affairs Professional Industrial Hygienist.

**VA Certified Industrial Hygienist (VPCIH)** - Department of Veteran's Affairs Professional Certified Industrial Hygienist.

**VA Representative** - The VA official responsible for on-going project work.

**Visible emissions** - Any emissions, which are visually detectable without the aid of instruments, coming from ACM/PACM/RACM or ACM waste material.

**Waste/Equipment decontamination facility (W/EDF)** - The area in which equipment is decontaminated before removal from the regulated area.

**Waste generator** - Any owner or operator whose act or process produces asbestos-containing waste material.

**Waste shipment record** - The shipping document, required to be originated and signed by the waste generator, used to track and substantiate the disposition of asbestos-containing waste material.

**Wet cleaning** - The process of thoroughly eliminating, by wet methods, any asbestos contamination from surfaces or objects.

#### **1.4.3 REFERENCED STANDARDS ORGANIZATIONS**

The following acronyms or abbreviations as referenced in contract/specification documents are defined to mean the associated names. Names and addresses may be subject to change.

- A. VA Department of Veterans Affairs  
810 Vermont Avenue, NW  
Washington, DC 20420
- B. AIHA American Industrial Hygiene Association  
2700 Prosperity Avenue, Suite 250  
Fairfax, VA 22031  
703-849-8888
- C. ANSI American National Standards Institute  
1430 Broadway

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212-354-3300

- D. ASTM American Society for Testing and Materials  
1916 Race St.  
Philadelphia, PA 19103  
215-299-5400
- E. CFR Code of Federal Regulations  
Government Printing Office  
Washington, DC 20420
- F. CGA Compressed Gas Association  
1235 Jefferson Davis Highway  
Arlington, VA 22202  
703-979-0900
- G. CS Commercial Standard of the National Institute of Standards and Technology (NIST)  
U. S. Department of Commerce  
Government Printing Office  
Washington, DC 20420
- H. EPA Environmental Protection Agency  
401 M St., SW  
Washington, DC 20460  
202-382-3949
- I. MIL-STD Military Standards/Standardization Division  
Office of the Assistant Secretary of Defense  
Washington, DC 20420
- J. MSHA Mine Safety and Health Administration  
Respiratory Protection Division  
Ballston Tower #3  
Department of Labor  
Arlington, VA 22203  
703-235-1452
- K. NIST National Institute for Standards and Technology  
U. S. Department of Commerce  
Gaithersburg, MD 20234  
301-921-1000
- L. NEC National Electrical Code (by NFPA)
- M. NEMA National Electrical Manufacturer's Association  
2101 L Street, N.W.  
Washington, DC 20037
- N. NFPA National Fire Protection Association  
1 Batterymarch Park  
P.O. Box 9101  
Quincy, MA 02269-9101  
800-344-3555
- O. NIOSH National Institutes for Occupational Safety and Health  
4676 Columbia Parkway  
Cincinnati, OH 45226  
513-533-8236
- P. OSHA Occupational Safety and Health Administration  
U.S. Department of Labor  
Government Printing Office  
Washington, DC 20402
- Q. UL Underwriters Laboratory  
333 Pfingsten Rd.

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Northbrook, IL 60062  
312-272-8800

R. USA United States Army  
Army Chemical Corps  
Department of Defense  
Washington, DC 20420

**1.5 APPLICABLE CODES AND REGULATIONS**

**1.5.1 GENERAL APPLICABILITY OF CODES, REGULATIONS, AND STANDARDS**

- A. All work under this contract shall be done in strict accordance with all applicable Federal, State, and local regulations, standards and codes governing asbestos abatement, and any other trade work done in conjunction with the abatement. All applicable codes, regulations and standards are adopted into this specification and will have the same force and effect as this specification.
- B. The most recent edition of any relevant regulation, standard, document or code shall be in effect. Where conflict among the requirements or with these specification exists, the most stringent requirement(s) shall be utilized.
- C. Copies of all standards, regulations, codes and other applicable documents, including this specification and those listed in Section 1.5 shall be available at the worksite in the clean change area of the worker decontamination system. The contractor shall be responsible for providing these documents.

**1.5.2 ASBESTOS ABATEMENT CONTRACTOR RESPONSIBILITY**

The Asbestos Abatement Contractor (Contractor) shall assume full responsibility and liability for compliance with all applicable Federal, State and Local regulations related to any and all aspects of the abatement project. The Contractor is responsible for providing and maintaining training, accreditations, medical exams, medical records, personal protective equipment as required by applicable Federal, State and Local regulations. The Contractor shall hold the VA and VPIH/CIH consultants harmless for any Contractor's failure to comply with any applicable work, packaging, transporting, disposal, safety, health, or environmental requirement on the part of himself, his employees, or his subcontractors. The Contractor will incur all costs of the CPIH, including all sampling/analytical costs to assure compliance with OSHA/EPA/State requirements related to failure to comply with the regulations applicable to the work.

Abatement Contractor shall determine the applicability of any process patents he/she may be employing and be responsible for paying any fees, royalties or licenses that may be required for the use of patented processes.

**1.5.3 FEDERAL REQUIREMENTS**

Federal requirements which govern asbestos abatement include, but are not limited to, the following regulations.

- A. Occupational Safety and Health Administration (OSHA)
  - 1. Title 29 CFR 1926.1101 - Construction Standard for Asbestos
  - 2. Title 29 CFR 1910.132 - Personal Protective Equipment
  - 3. Title 29 CFR 1910.134 - Respiratory Protection
  - 4. Title 29 CFR 1926 - Construction Industry Standards

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- 5. Title 29 CFR 1910.20 - Access to Employee Exposure and Medical Records
- 6. Title 29 CFR 1910.1200 - Hazard Communication
- 7. Title 29 CFR 1910.151 - Medical and First Aid
- B. Environmental Protection Agency (**EPA**):
  - 1. 40 CFR 61 Subpart A and M (Revised Subpart B) - National Emission Standard for Hazardous Air Pollutants - Asbestos.
  - 2. 40 CFR 763.80 - Asbestos Hazard Emergency Response Act (AHERA)
- C. Department of Transportation (**DOT**)
  - Title 49 CFR 100 - 185 - Transportation

**1.5.4 STATE REQUIREMENTS**

State requirements which govern asbestos abatement work or hauling and disposal of asbestos waste materials include but are not limited to the following:

- A. State of New York Asbestos Regulations
  - Title 12, NYCRR Part 56 and subsequent amendments
- B. New York State Department of Environmental Conservation
  - Title 6, NYCRR
    - 1. NYCRR Part 360 - Solid Waste Management Facilities
    - 2. NYCRR Part 364 - Waste Transporter Permits

**1.5.5 LOCAL REQUIREMENTS**

- A. New York City Department of Environmental Protection Code of Rules and Regulations

Chapter I, Title 15: Asbestos Safety Program Requirements

**1.5.6 STANDARDS**

- A. Standards which govern asbestos abatement activities include, but are not limited to, the following:
  - 1. American National Standards Institute (ANSI) Z9.2-79 - Fundamentals Governing the Design and Operation of Local Exhaust Systems Z88.2 - Practices for Respiratory Protection.
  - 2. Underwriters Laboratories (UL) 586-90 - UL Standard for Safety of HEPA Filter Units, 7th Edition.
- B. Standards which govern encapsulation work include, but are not limited to the following:
  - 1. American Society for Testing and Materials (ASTM)
- C. Standards which govern the fire and safety concerns in abatement work include, but are not limited to, the following:
  - 1. National Fire Protection Association (NFPA) 241 - Standard for Safeguarding Construction, Alteration, and Demolition Operations.
  - 2. NFPA 701 - Standard Methods for Fire Tests for Flame Resistant Textiles and Film.
  - 3. NFPA 101 - Life Safety Code

**1.5.7 EPA GUIDANCE DOCUMENTS**

- A. EPA guidance documents which discuss asbestos abatement work activities are listed below. These documents are made part of this section by reference. EPA publications can be ordered from (800) 424-9065.
- B. Guidance for Controlling ACM in Buildings (Purple Book) EPA 560/5-85-024
- C. Asbestos Waste Management Guidance EPA 530-SW-85-007
- D. A Guide to Respiratory Protection for the Asbestos Abatement Industry EPA-560-OPTS-86-001
- E. Guide to Managing Asbestos in Place (Green Book) TS 799 20T July 1990

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**1.5.8 NOTICES**

- A. Federal, State and Local Agencies: Send written notification as required by federal, state and local regulations including the local fire department prior to beginning any work on asbestos containing materials as follows:
1. The Contractor shall send written notification as required by USEPA National Emission Standards for Hazardous Air Pollutants (NESHAP's) Asbestos Regulations (40 CFR 61, Subpart M) to the regional asbestos NESHAP's Contact at least 10 working days prior to beginning work on asbestos-containing materials on a form approved by the USEPA. Send notification to the following address by certified mail return receipt requested:  
  
USEPA  
Region II  
Asbestos NESHAP's Coordinator  
Air and Waste Management Division  
26 Federal Plaza  
New York, New York 10007
  2. Include, as a minimum, the following information in the notification sent to the NESHAP's contact:
    - a. Name and address of VA Medical Center.
    - b. Description of the facility being demolished or renovated, including the size, age, and prior use of the facility.
    - c. Estimate of the approximate amount of friable asbestos-containing material present in the facility in terms of linear feet of pipe, and surface area on other facility components.
    - d. Location of the facility being demolished or renovated.
    - e. Scheduled starting and completion dates of demolition or renovation.
    - f. Nature of planned demolition or renovation and method(s) to be used.
    - g. Procedures to be used to comply with the requirements of USEPA National Emission Standards for Hazardous Air Pollutants (NESHAP's) Asbestos Regulations (40 CFR 61 Subpart M).
    - h. Name and location of the waste disposal site where the friable asbestos waste material will be deposited.
- B. State Agencies  
Send written notification, by certified mail return receipt requested, to New York State Department of Labor, Division of Safety and Health, Asbestos Control Program, on form provided by the Department, as required, 10 days prior to beginning any work on asbestos-containing materials.
- C. Copies  
Copies of notifications shall be submitted to VA for the facility's records in the same time frame notification is given to EPA, State, and Local authorities.
- D. Variances  
Contractor shall obtain and comply with all necessary variances from federal, state, and local regulatory agencies prior to starting any

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work on the project. Prior to any variance application, obtain written approval from the DVA Resident Engineer.

**1.5.9 PERMITS/LICENSES**

- A. The contractor shall apply for and have all required permits and licenses to perform asbestos abatement work as required by Federal, State, and Local regulations. The contractor shall be currently licensed by the New York State Department of Labor as an Asbestos Abatement Contractor.

**1.5.10 POSTING AND FILING OF REGULATIONS**

- A. Maintain two (2) copies of applicable federal, state, and local regulations. Post one copy of each in the clean room at the regulated area where workers will have daily access to the regulations and keep another copy in the Contractor's office.

**1.5.11 VA RESPONSIBILITIES**

Prior to commencement of work:

- A. Notify occupants adjacent to regulated areas of project dates and requirements for relocation, if needed. Arrangements must be made prior to starting work for relocation of desks, files, equipment and personal possessions to avoid unauthorized access into the regulated area. **Note: Notification of adjacent personnel is required by OSHA in 29 CFR 1926.1101 (k) to prevent unnecessary or unauthorized access to the regulated area.**
- B. Submit to the Contractor results of background air sampling; including location of samples, person who collected the samples, equipment utilized and method of analysis. During abatement, submit to the Contractor, results of bulk material analysis and air sampling data collected during the course of the abatement. This information shall not release the Contractor from any responsibility for OSHA compliance.

**1.5.12 SITE SECURITY**

- A. Regulated area access is to be restricted only to authorized, trained/accredited and protected personnel. These may include the Contractor's employees, employees of Subcontractors, VA employees and representatives, State and local inspectors, and any other designated individuals. A list of authorized personnel shall be established prior to commencing the project and be posted in the clean room of the decontamination unit.
- B. Entry into the regulated area by unauthorized individuals shall be reported immediately to the Competent Person by anyone observing the entry. The Competent Person shall immediately notify the VA.
- C. A log book shall be maintained in the clean room of the decontamination unit. Anyone who enters the regulated area must record their name, affiliation, time in, and time out for each entry.
- D. Access to the regulated area shall be through a single decontamination unit. All other access (doors, windows, hallways, etc.) shall be sealed or locked to prevent entry to or exit from the regulated area. The only exceptions for this requirement are the waste/equipment load-out area which shall be sealed except during the removal of containerized asbestos waste from the regulated area, and emergency exits. Emergency exits shall not be locked from the inside, however, they shall be sealed with poly sheeting and taped until needed.
- E. The Contractor's Competent Person shall control site security during abatement operations in order to isolate work in progress and protect adjacent personnel. A 24 hour security system shall be provided at the



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entrance to the regulated area to assure that all entrants are logged in/out and that only authorized personnel are allowed entrance.

- F. The Contractor will have the VA's assistance in notifying adjacent personnel of the presence, location and quantity of ACM in the regulated area and enforcement of restricted access by the VA's employees.
- G. The regulated area shall be locked during non-working hours and secured by VA security/police guards.

**1.5.13 EMERGENCY ACTION PLAN AND ARRANGEMENTS**

- A. An Emergency Action Plan shall be developed by prior to commencing abatement activities and shall be agreed to by the Contractor and the VA. The Plan shall meet the requirements of 29 CFR 1910.38 (a);(b).
- B. Emergency procedures shall be in written form and prominently posted in the clean room and equipment room of the decontamination unit. Everyone, prior to entering the regulated area, must read and sign these procedures to acknowledge understanding of the regulated area layout, location of emergency exits and emergency procedures.
- C. Emergency planning shall include written notification of police, fire, and emergency medical personnel of planned abatement activities; work schedule; layout of regulated area; and access to the regulated area, particularly barriers that may affect response capabilities.
- D. Emergency planning shall include consideration of fire, explosion, hazardous atmospheres, electrical hazards, slips/trips and falls, confined spaces, and heat stress illness. Written procedures for response to emergency situations shall be developed and employee training in procedures shall be provided.
- E. Employees shall be trained in regulated area/site evacuation procedures in the event of workplace emergencies.
  - 1. For non life-threatening situations - employees injured or otherwise incapacitated shall decontaminate following normal procedures with assistance from fellow workers, if necessary, before exiting the regulated area to obtain proper medical treatment.
  - 2. For life-threatening injury or illness, worker decontamination shall take least priority after measures to stabilize the injured worker, remove them from the regulated area, and secure proper medical treatment.
- F. Telephone numbers of any/all emergency response personnel shall be prominently posted in the clean room, along with the location of the nearest telephone.
- G. The Contractor shall provide verification of first aid/CPR training for personnel responsible for providing first aid/CPR. OSHA requires medical assistance within 3-4 minutes of a life-threatening injury/illness. Bloodborne Pathogen training shall also be verified for those personnel required to provide first aid/CPR.
- H. The Emergency Action Plan shall provide for a Contingency Plan in the event that an incident occurs that may require the modification of the standard operating procedures during abatement. Such incidents include, but are not limited to, fire; accident; power failure; negative pressure failure; and supplied air system failure. The Contractor shall detail procedures to be followed in the event of an incident assuring that asbestos abatement work is stopped and wetting is continued until correction of the problem.

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**1.5.14 PRE-CONSTRUCTION MEETING**

Prior to commencing the work, the Contractor shall meet with the VA Certified Industrial Hygienist (VCIH) to present and review, as appropriate, the items following this paragraph. The Contractor's Competent Person(s) who will be on-site shall participate in the pre-start meeting. The pre-start meeting is to discuss and determine procedures to be used during the project. At this meeting, the Contractor shall provide:

- A. Proof of Contractor licensing.
- B. Proof the Competent Person(s) is trained and accredited and approved for working in this State. Verification of the experience of the Competent Person(s) shall also be presented.
- C. A list of all workers who will participate in the project, including experience and verification of training and accreditation.
- D. A list of and verification of training for all personnel who have current first-aid/CPR training. A minimum of one person per shift must have adequate training.
- E. Current medical written opinions for all personnel working on-site meeting the requirements of 29 CFR 1926.1101 (m).
- F. Current fit-tests for all personnel wearing respirators on-site meeting the requirements of 29 CFR 1926.1101 (h) and Appendix C.
- G. A copy of the Contractor's Standard Operating Procedures for Asbestos Abatement. In these procedures, the following information must be detailed, specific for this project.
  - 1. Regulated area preparation procedures;
  - 2. Notification requirements procedure of Contractor as required in 29 CFR 1926.1101 (d);
  - 3. Decontamination area set-up/layout and decontamination procedures for employees;
  - 4. Abatement methods/procedures and equipment to be used;
  - 5. Personal protective equipment to be used;
- H. At this meeting the Contractor shall provide all submittals as required.
- I. Procedures for handling, packaging and disposal of asbestos waste.
- J. Emergency Action Plan and Contingency Plan Procedures.

**1.6 PROJECT COORDINATION**

The following are the minimum administrative and supervisory personnel necessary for coordination of the work.

**1.6.1 PERSONNEL**

- A. Administrative and supervisory personnel shall consist of a qualified Competent Person(s) as defined by OSHA in the Construction Standards and the Asbestos Construction Standard; Contractor Professional Industrial Hygienist and Industrial Hygiene Technicians. These employees are the Contractor's representatives responsible for compliance with these specifications and all other applicable requirements.
- B. Non-supervisory personnel shall consist of an adequate number of qualified personnel to meet the schedule requirements of the project. Personnel shall meet required qualifications. Personnel utilized on-site shall be pre-approved by the VA representative. A request for approval shall be submitted for any person to be employed during the project giving the person's name; social security number; qualifications; accreditation card with color picture; Certificate of

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Worker's Acknowledgment; and Affidavit of Medical Surveillance and Respiratory Protection and current Respirator Fit Test.

**C. Minimum qualifications for Contractor and assigned personnel are:**

1. The Contractor has conducted within the last three (3) years, three (3) projects of similar complexity and dollar value as this project; has not been cited and penalized for serious violations of asbestos regulations in the past three (3) years; has adequate liability/occurrence insurance for asbestos work; is licensed in applicable states; has adequate and qualified personnel available to complete the work; has comprehensive standard operating procedures for asbestos work; has adequate materials, equipment and supplies to perform the work.
2. The Competent Person has four (4) years of abatement experience of which two (2) years were as the Competent Person on the project; meets the OSHA definition of a Competent Person; has been the Competent Person on two (2) projects of similar size and complexity as this project; has completed EPA AHERA/OSHA/State/Local training requirements/accreditation(s) and refreshers; and has all required OSHA documentation related to medical and respiratory protection.
3. The Contractor Professional Industrial Hygienist (CPIH) shall have five (5) years of monitoring experience and supervision of asbestos abatement projects; has participated as senior IH on five (5) abatement projects, three (3) of which are similar in size and complexity as this project; has developed at least one complete standard operating procedure for asbestos abatement; has trained abatement personnel for three (3) years; has specialized EPA AHERA/OSHA training in asbestos abatement management, respiratory protection, waste disposal and asbestos inspection; has completed the NIOSH 582 Course, Contractor/Supervisor course; and has appropriate medical/respiratory protection records/documentation.
4. The Abatement Personnel shall have completed the EPA AHERA/OSHA abatement worker course; have training on the standard operating procedures of the Contractor; has one year of asbestos abatement experience; has applicable medical and respiratory protection documentation; has certificate of training/current refresher and State accreditation/license.

**1.7 RESPIRATORY PROTECTION**

**1.7.1 GENERAL - RESPIRATORY PROTECTION PROGRAM**

The Contractor shall develop and implement a Respiratory Protection Program (RPP) which is in compliance with the January 8, 1998 OSHA requirements found at 29 CFR 1926.1101 and 29 CFR 1910.132;134. ANSI Standard Z88.2-1992 provides excellent guidance for developing a respiratory protection program. All respirators used must be NIOSH approved for asbestos abatement activities. The written respiratory protection shall, at a minimum, contain the basic requirements found at 29 CFR 1910.134 (c)(1)(i - ix) - Respiratory Protection Program.

**1.7.2 RESPIRATORY PROTECTION PROGRAM COORDINATOR**

The Respiratory Protection Program Coordinator (RPPC) must be identified and shall have two (2) years experience coordinating the program. The RPPC must submit a signed statement attesting to the fact that the program meets the above requirements.

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**1.7.3 SELECTION AND USE OF RESPIRATORS**

The procedure for the selection and use of respirators must be submitted to the VA as part of the Contractor's qualification. The procedure must be written clearly enough for workers to understand. A copy of the Respiratory Protection Program must be available in the clean room of the decontamination unit for reference by employees or authorized visitors.

**1.7.4 MINIMUM RESPIRATORY PROTECTION**

Minimum respiratory protection shall be a full face powered air purifying respirator when fiber levels are maintained consistently at or below 0.5 f/cc. A higher level of respiratory protection may be provided or required, depending on fiber levels. Respirator selection shall meet the requirements of 29 CFR 1926.1101 (h); Table 1, except as indicated in this paragraph. Abatement personnel must have a respirator for their exclusive use.

**1.7.5 MEDICAL WRITTEN OPINION**

No employee shall be allowed to wear a respirator unless a physician has determined they are capable of doing so and has issued a current written opinion for that person.

**1.7.6 RESPIRATOR FIT TEST**

All personnel wearing respirators shall have a current qualitative/quantitative fit test which was conducted in accordance with 29 CFR 1910.134 (f) and Appendix A. Quantitative fit tests shall be done for PAPR's which have been put into a failure mode.

**1.7.7 RESPIRATOR FIT CHECK**

The Competent Person shall assure that the positive/negative fit check is done each time the respirator is donned by an employee. Headcoverings must cover respirator headstraps. Any situation that prevents an effective facepiece to face seal as evidenced by failure of a fit check shall preclude that person from wearing a respirator until resolution of the problem.

**1.7.8 MAINTENANCE AND CARE OF RESPIRATORS**

The Respiratory Protection Program Coordinator shall submit evidence and documentation showing compliance with 29 CFR 1910.134 (h) Maintenance and care of respirators.

**1.7.9 SUPPLIED AIR SYSTEMS**

If a supplied air system is used, the system shall meet all requirements of 29 CFR 1910.134 and the ANSI/Compressed Gas Association (CGA) Commodity Specification for Air current requirements for Type 1 - Grade D breathing air. Low pressure systems are not allowed to be used on asbestos abatement projects. Supplied Air respirator use shall be in accordance with EPA/NIOSH publication EPA-560-OPTS-86-001 "A Guide to Respiratory Protection for the Asbestos Abatement Industry".

**1.8 WORKER PROTECTION**

**1.8.1 TRAINING OF ABATEMENT PERSONNEL**

Prior to beginning any abatement activity, all personnel shall be trained in accordance with OSHA 29 CFR 1926.1101 (k)(9) and any additional State/Local requirements. Training must include, at a minimum, the elements listed at 29 CFR 1926.1101 (k)(9)(viii). Training shall have been conducted by a third party, EPA/State approved trainer meeting the requirements of EPA 40 CFR 763 Appendix C (AHERA MAP).

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Initial training certificates and current refresher and accreditation proof must be submitted for each person working at the site.

**1.8.2 MEDICAL EXAMINATIONS**

Medical examinations meeting the requirements of 29 CFR 1926.1101 (m) shall be provided for all personnel working in the regulated area, regardless of exposure levels. A current physician's written opinion as required by 29 CFR 1926.1101 (m)(4) shall be provided for each person and shall include in the opinion the person has been evaluated for working in a heat stress environment while wearing personal protective equipment and is able to perform the work.

**1.8.3 PERSONAL PROTECTIVE EQUIPMENT**

Provide whole body clothing, head coverings, gloves and foot coverings and any other personal protective equipment as determined by conducting the hazard assessment required by OSHA at 29 CFR 1910.132 (d). The Competent Person shall ensure the integrity of personal protective equipment worn for the duration of the project. Duct tape shall be used to secure all suit sleeves to wrists and to secure foot coverings at the ankle.

**1.8.4 REGULATED AREA ENTRY PROCEDURE**

The Competent Person shall ensure that each time workers enter the regulated area, they remove ALL street clothes in the clean room of the decontamination unit and put on new disposable coveralls, head coverings, a clean respirator, and then proceed through the shower room to the equipment room where they put on non-disposable required personal protective equipment.

**1.8.5 DECONTAMINATION PROCEDURE - PAPR**

The Competent Person shall require all personnel to adhere to following decontamination procedures whenever they leave the regulated area.

- A. When exiting the regulated area, remove disposable coveralls, and ALL other clothes, disposable head coverings, and foot coverings or boots in the equipment room.
- B. Still wearing the respirator and completely naked, proceed to the shower. Showering is MANDATORY. Care must be taken to follow reasonable procedures in removing the respirator to avoid asbestos fibers while showering. The following procedure is required as a minimum:
  1. Thoroughly wet body including hair and face. If using a PAPR hold blower above head to keep filters dry.
  2. With respirator still in place, thoroughly decontaminate body, hair, respirator face piece, and all other parts of the respirator except the blower and battery pack on a PAPR. Pay particular attention to cleaning the seal between the face and respirator facepiece and under the respirator straps.
  3. Take a deep breath, hold it and/or exhale slowly, completely wetting hair, face, and respirator. While still holding breath, remove the respirator and hold it away from the face before starting to breathe.
- C. Carefully decontaminate the facepiece of the respirator inside and out. If using a PAPR, shut down using the following sequence: a) first cap inlets to filters; b) turn blower off to keep debris collected on the inlet side of the filter from dislodging and contaminating the outside of the unit; c) thoroughly decontaminate blower and hoses; d) carefully decontaminate battery pack with a wet rag being cautious of getting

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water in the battery pack thus preventing destruction. **(THIS PROCEDURE IS NOT A SUBSTITUTE FOR RESPIRATOR CLEANING!)**.

- D. Shower and wash body completely with soap and water. Rinse thoroughly.
- E. Rinse shower room walls and floor to drain prior to exiting.
- F. Proceed from shower to clean room; dry off and change into street clothes or into new disposable work clothing.

**1.8.6 REGULATED AREA REQUIREMENTS**

The Competent Person shall meet all requirements of 29 CFR 1926.1101 (o) and assure that all requirements for regulated areas at 29 CFR 1926.1101 (e) are met. All personnel in the regulated area shall not be allowed to eat, drink, smoke, chew tobacco or gum, apply cosmetics, or in any way interfere with the fit of their respirator.

**1.9 DECONTAMINATION FACILITIES**

**1.9.1 DESCRIPTION**

Provide each regulated area with separate personnel (PDF) and waste/equipment decontamination facilities (W/EDF). Ensure that the PDF are the only means of ingress and egress to the regulated area and that all equipment, bagged waste, and other material exit the regulated area only through the W/EDF.

**1.9.2 GENERAL REQUIREMENTS**

All personnel entering or exiting a regulated area must go through the PDF and shall follow the requirements at 29 CFR 1926.1101 (j)(1) and these specifications. All waste, equipment and contaminated materials must exit the regulated area through the W/EDF and be decontaminated in accordance with these specifications. Walls and ceilings of the PDF and W/EDF must be constructed of a minimum of 3 layers of 6 mil opaque fire retardant polyethylene sheeting and be securely attached to existing building components and/or an adequate temporary framework. A minimum of 3 layers of 6 mil poly shall also be used to cover the floor under the PDF and W/EDF units. Construct doors so that they overlap and secure to adjacent surfaces. Weight inner doorway sheets with layers of duct tape so that they close quickly after release. Put arrows on sheets so they show direction of travel and overlap. If the building adjacent area is occupied, construct a solid barrier on the occupied side(s) to protect the sheeting and reduce potential for non-authorized personnel entering the regulated area.

**1.9.3 TEMPORARY FACILITIES TO THE PDF AND W/EDF**

The Competent Person shall provide temporary water service connections to the PDF and W/EDF. Backflow prevention must be provided at the point of connection to the VA system. Water supply must be of adequate pressure and meet requirements of 29 CFR 1910.141(d)(3). Provide adequate temporary overhead electric power with ground fault circuit interruption (GFCI) protection. Provide a sub-panel for all temporary power in the clean room. Provide adequate lighting to provide a minimum of 50 foot candles in the PDF and W/EDF. Provide temporary heat, if needed, to maintain 70°F throughout the PDF and W/EDF.

**1.9.4 PERSONNEL DECONTAMINATION FACILITY (PDF)**

The Competent Person shall provide a PDF consisting of shower room which is contiguous to a clean room and equipment room which is connected to the regulated area. The PDF must be sized to accommodate the number of personnel scheduled for the project. The shower room, located in the center of the PDF, shall be fitted with as many portable

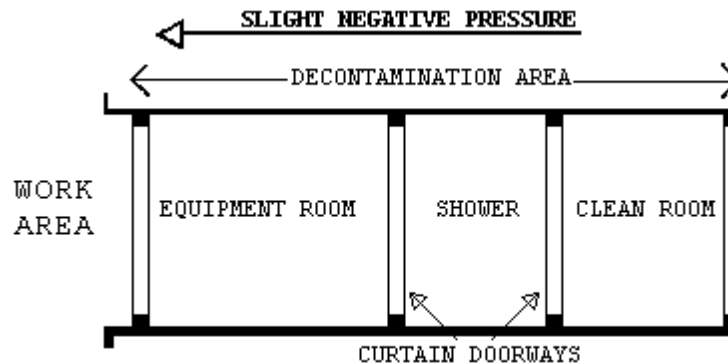
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showers as necessary to insure all employees can complete the entire decontamination procedure within 15 minutes. The PDF shall be constructed of opaque poly for privacy. The PDF shall be constructed to eliminate any parallel routes of egress without showering.

1. Clean Room: The clean room must be physically and visually separated from the rest of the building to protect the privacy of personnel changing clothes. The clean room shall be constructed of at least 3 layers of 6 mil opaque fire retardant poly to provide an air tight room. Provide a minimum of 2 - 900 mm (3 foot) wide 6 mil poly opaque fire retardant doorways. One doorway shall be the entry from outside the PDF and the second doorway shall be to the shower room of the PDF. The floor of the clean room shall be maintained in a clean, dry condition. Shower overflow shall not be allowed into the clean room. Provide 1 storage locker per person. A portable fire extinguisher, Type ABC, shall be provided in accordance with OSHA and NFPA Standard 10. All persons entering the regulated area shall remove all street clothing in the clean room and dress in disposable protective clothing and respiratory protection. Any person entering the clean room does so either from the outside with street clothing on or is coming from the shower room completely naked and thoroughly washed. Females required to enter the regulated area shall be ensured of their privacy throughout the entry/exit process by posting guards at both entry points to the PDF so no male can enter or exit the PDF during her stay in the PDF.
2. Shower Room: The Competent Person shall assure that the shower room is a completely water tight compartment to be used for the movement of all personnel from the clean room to the equipment room and for the showering of all personnel going from the equipment room to the clean room. Each shower shall be constructed so water runs down the walls of the shower and into a drip pan. Install a freely draining smooth floor on top of the shower pan. The shower room shall be separated from the rest of the building and from the clean room and equipment room using air tight walls made from at least 3 layers of 6 mil opaque fire retardant poly. The shower shall be equipped with a shower head and controls, hot and cold water, drainage, soap dish and continuous supply of soap, and shall be maintained in a sanitary condition throughout its use. The controls shall be arranged so an individual can shower without assistance. Provide a flexible hose shower head, hose bibs and all other items shown on Shower Schematic. Waste water will be pumped to a drain after being filtered through a minimum of a 100 micron sock in the shower drain; a 20 micron filter; and a final 5 micron filter. Filters will be changed a minimum of daily or more often as needed. Filter changes must be done in the shower to prevent loss of contaminated water. Hose down all shower surfaces after each shift and clean any debris from the shower pan. Residue is to be disposed of as asbestos waste.
3. Equipment Room: The Competent Person shall provide an equipment room which shall be an air tight compartment for the storage of work equipment/tools, reusable personal protective equipment, except for a respirator and for use as a gross decontamination area for personnel exiting the regulated area. The equipment room shall be separated from the regulated area by a minimum 3 foot wide door made with 2 layers of 6 mil opaque fire retardant poly. The equipment room shall be separated from the regulated area, the shower room and the rest of the building by air tight walls and ceiling constructed

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- of a minimum of 3 layers of 6 mil opaque fire retardant poly. Damp wipe all surfaces of the equipment room after each shift change. Provide an additional loose layer of 6 mil fire retardant poly per shift change and remove this layer after each shift. If needed, provide a temporary electrical sub-panel equipped with GFCI in the equipment room to accommodate any equipment required in the regulated area.
4. The PDF shall look like as follows: Clean room at the entrance followed by a shower room followed by an equipment room leading to the regulated area. Each doorway in the PDF is minimum of 2 layers of 6 mil opaque fire retardant poly.



**1.9.5 WASTE/EQUIPMENT DECONTAMINATION FACILITY (W/EDF)**

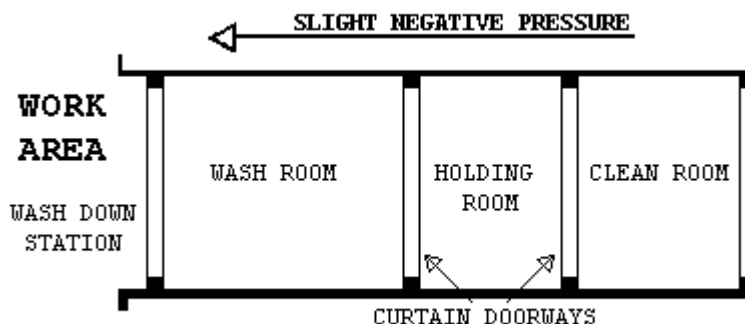
The Competent Person shall provide an W/EDF consisting of a wash room, holding room, and clean room for removal of waste, equipment and contaminated material from the regulated area. Personnel shall not enter or exit the W/EDF except in the event of an emergency. Clean debris and residue in the W/EDF daily. All surfaces in the W/EDF shall be wiped/hosed down after each shift and all debris shall be cleaned from the shower pan. The W/EDF shall consist of the following:

1. Wash Down Station: Provide an enclosed shower unit in the regulated area just outside the Wash Room as an equipment bag and container cleaning station.
2. Wash Room: Provide a wash room for cleaning of bagged or containerized asbestos containing waste materials passed from the regulated area. Construct the wash room using 50 x 100 mm (2" x 4") wood framing and 3 layers of 6 mil fire retardant poly. Locate the wash room so that packaged materials, after being wiped clean, can be passed to the Holding Room. Doorways in the wash room shall be constructed of 2 layers of 6 mil fire retardant poly.
3. Holding Room: Provide a holding room as a drop location for bagged materials passed from the wash room. Construct the holding room using 50 x 100 mm (2" x 4") wood framing and 3 layers of 6 mil fire retardant poly. The holding room shall be located so that bagged material cannot be passed from the wash room to the clean room unless it goes through the holding room. Doorways in the holding room shall be constructed of 2 layers of 6 mil fire retardant poly.
4. Clean Room: Provide a clean room to isolate the holding room from the exterior of the regulated area. Construct the clean room using 2



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- x 4 wood framing and 2 layers of 6 mil fire retardant poly. The clean room shall be located so as to provide access to the holding room from the building exterior. Doorways to the clean room shall be constructed of 2 layers of 6 mil fire retardant poly. When a negative pressure differential system is used, a rigid enclosure separation between the W/EDF clean room and the adjacent areas shall be provided.
5. The W/EDF shall be provided as follows: Wash Room leading to a Holding Room followed by a Clean Room leading to outside the regulated area. See diagram.



#### **1.9.6 WASTE/EQUIPMENT DECONTAMINATION PROCEDURES**

At washdown station in the regulated area, thoroughly wet clean contaminated equipment and/or sealed polyethylene bags and pass into Wash Room after visual inspection. When passing anything into the Wash Room, close all doorways of the W/EDF, other than the doorway between the washdown station and the Wash Room. Keep all outside personnel clear of the W/EDF. Once inside the Wash Room, wet clean the equipment and/or bags. After cleaning and inspection, pass items into the Holding Room. Close all doorways except the doorway between the Holding Room and the Clean Room. Workers from the Clean Room/Exterior shall enter the Holding Room and remove the decontaminated/cleaned equipment/bags for removal and disposal. These personnel will not be required to wear PPE. At no time shall personnel from the clean side be allowed to enter the Wash Room.

#### **PART 2 - PRODUCTS, MATERIALS AND EQUIPMENT**

##### **2.1 MATERIALS AND EQUIPMENT**

###### **2.1.1 GENERAL REQUIREMENTS**

Prior to the start of work, the contractor shall provide and maintain a sufficient quantity of materials and equipment to assure continuous and efficient work throughout the duration of the project. Work shall not start unless the following items have been delivered to the site and the CPIH has submitted verification to the VA's representative.

- A. All materials shall be delivered in their original package, container or bundle bearing the name of the manufacturer and the brand name (where applicable).

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- B. Store all materials subject to damage off the ground, away from wet or damp surfaces and under cover sufficient enough to prevent damage or contamination. Flammable materials cannot be stored inside buildings. Replacement materials shall be stored outside of the regulated area until abatement is completed.
- C. The Contractor shall not block or hinder use of buildings by patients, staff, and visitors to the VA in partially occupied buildings by placing materials/equipment in any unauthorized place.
- D. The Competent Person shall inspect for damaged, deteriorating or previously used materials. Such materials shall not be used and shall be removed from the worksite and disposed of properly.
- E. Polyethylene sheeting for walls in the regulated area shall be a minimum of 6-mils. For floors and all other uses, sheeting of at least 6-mils shall be used in widths selected to minimize the frequency of joints. Fire retardant poly shall be used throughout.
- F. The method of attaching polyethylene sheeting shall be agreed upon in advance by the Contractor and the VA and selected to minimize damage to equipment and surfaces. Method of attachment may include any combination of moisture resistant duct tape furring strips, spray glue, staples, nails, screws, lumber and plywood for enclosures or other effective procedures capable of sealing polyethylene to dissimilar finished or unfinished surfaces under both wet and dry conditions.
- G. Polyethylene sheeting utilized for the PDF shall be opaque white or black in color, 6 mil fire retardant poly.
- H. Installation and plumbing hardware, showers, hoses, drain pans, sump pumps and waste water filtration system shall be provided by the Contractor.
- I. An adequate number of HEPA vacuums, scrapers, sprayers, nylon brushes, brooms, disposable mops, rags, sponges, staple guns, shovels, ladders and scaffolding of suitable height and length as well as meeting OSHA requirements, fall protection devices, water hose to reach all areas in the regulated area, airless spray equipment, and any other tools, materials or equipment required to conduct the abatement project. All electrically operated hand tools, equipment, electric cords shall be connected to GFCI protection.
- J. Special protection for objects in the regulated area shall be detailed (e.g., plywood over carpeting or hardwood floors to prevent damage from scaffolds, water and falling material).
- K. Disposal bags - 2 layers of 6 mil, for asbestos waste shall be pre-printed with labels, markings and address as required by OSHA, EPA and DOT regulations.
- L. The VA shall be provided a copy of the MSDS as required for all hazardous chemicals under OSHA 29 CFR 1910.1200 - Hazard Communication. Chlorinated compounds shall not be used with any spray adhesive or other product. Appropriate encapsulant(s) shall be provided.
- M. OSHA DANGER demarcation signs, as many and as required by OSHA 29 CFR 1926.1101(k)(7) shall be provided and placed by the Competent Person. All other posters and notices required by Federal and State regulations shall be posted in the Clean Room.
- N. Adequate and appropriate PPE for the project and number of personnel/shifts shall be provided. All personal protective equipment issued must be based on a hazard assessment conducted under 29 CFR 1910.132(d).

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**2.1.2 NEGATIVE PRESSURE FILTRATION SYSTEM**

The Contractor shall provide enough HEPA negative air machines to completely exchange the regulated area air volume 4 times per hour. The Competent Person shall determine the number of units needed for the regulated area by dividing the cubic feet in the regulated area by 15 and then dividing that result by the cubic feet per minute (CFM) for each unit to determine the number of units needed to effect 4 air changes per hour. Provide a standby unit in the event of machine failure and/or emergency in an adjacent area. NIOSH has done extensive studies and has determined that negative air machines typically operate at ~50% efficiency. The contractor shall consider this in their determination of number of units needed to provide 4 air changes per hour. The contractor shall use 8 air changes per hour or double the number of machines based on their calculations or submit proof their machines operate at stated capacities at a 2" pressure drop across the filters.

**2.1.3 DESIGN AND LAYOUT**

- A. Before start of work submit the design and layout of the regulated area and the negative air machines. The submittal shall indicate the number of, location of and size of negative air machines. The point(s) of exhaust, air flow within the regulated area, anticipated negative pressure differential, and supporting calculations for sizing shall be provided. In addition, submit the following:
  - 1. Method of supplying power to the units and designation/location of the panels.
  - 2. Description of testing method(s) for correct air volume and pressure differential.
  - 3. If auxiliary power supply is to be provided for the negative air machines, provide a schematic diagram of the power supply and manufacturer's data on the generator and switch.

**2.1.4 NEGATIVE AIR MACHINES (HEPA UNITS)**

- A. Negative Air Machine Cabinet: The cabinet shall be constructed of steel or other durable material capable of withstanding potential damage from rough handling and transportation. The width of the cabinet shall be less than 30" in order to fit in standard doorways. The cabinet must be factory sealed to prevent asbestos fibers from being released during use, transport, or maintenance. Any access to and replacement of filters shall be from the inlet end. The unit must be on casters or wheels.
- B. Negative Air Machine Fan: The rating capacity of the fan must indicate the CFM under actual operating conditions. Manufacturer's typically use "free-air" (no resistance) conditions when rating fans. The fan must be a centrifugal type fan.
- C. Negative Air Machine Final Filter: The final filter shall be a HEPA filter. The filter media must be completely sealed on all edges within a structurally rigid frame. The filter shall align with a continuous flexible gasket material in the negative air machine housing to form an air tight seal. Each HEPA filter shall be certified by the manufacturer to have an efficiency of not less than 99.97% when challenged with 0.3  $\mu\text{m}$  dioctylphthalate (DOP) particles. Testing shall have been done in accordance with Military Standard MIL-STD-282 and Army Instruction Manual 136-300-175A. Each filter must bear a UL586 label to indicate ability to perform under specified conditions. Each filter shall be

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marked with the name of the manufacturer, serial number, air flow rating, efficiency and resistance, and the direction of test air flow.

- D. Negative Air Machine Pre-filters: The pre-filters, which protect the final HEPA filter by removing larger particles, are required to prolong the operating life of the HEPA filter. Two stages of pre-filtration are required. A first stage pre-filter shall be a low efficiency type for particles 10  $\mu\text{m}$  or larger. A second stage pre-filter shall have a medium efficiency effective for particles down to 5  $\mu\text{m}$  or larger. Pre-filters shall be installed either on or in the intake opening of the NAM and the second stage filter must be held in place with a special housing or clamps.
- E. Negative Air Machine Instrumentation: Each unit must be equipped with a gauge to measure the pressure drop across the filters and to indicate when filters have become loaded and need to be changed. A table indicating the cfm for various pressure readings on the gauge shall be affixed near the gauge for reference or the reading shall indicate at what point the filters shall be changed, noting cfm delivery. The unit must have an elapsed time meter to show total hours of operation.
- F. Negative Air Machine Safety and Warning Devices: An electrical/mechanical lockout must be provide to prevent the fan from being operated without a HEPA filter. Units must be equipped with an automatic shutdown device to stop the fan in the event of a rupture in the HEPA filter or blockage in the discharge of the fan. Warning lights are required to indicate normal operation; too high a pressure drop across filters; or too low of a pressure drop across filters.
- G. Negative Air Machine Electrical: All electrical components shall be approved by the National Electrical Manufacturer's Association (NEMA) and Underwriter's Laboratories (UL). Each unit must be provided with overload protection and the motor, fan, fan housing, and cabinet must be grounded.

**2.1.5 PRESSURE DIFFERENTIAL**

The fully operational negative air system within the regulated area shall continuously maintain a pressure differential of -0.02" water column gauge. Before any disturbance of any asbestos material, this shall be demonstrated to the VA by use of a pressure differential meter/manometer as required by OSHA 29 CFR 1926.1101(e)(5)(i). The Competent Person shall be responsible for providing, maintaining, and documenting the negative pressure and air changes as required by OSHA and this specification.

**2.1.6 MONITORING**

The pressure differential shall be continuously monitored and recorded between the regulated area and the area outside the regulated area with a monitoring device that incorporates a strip chart recorder. The strip chart recorder shall become part of the project log and shall indicate at least -0.02" water column gauge for the duration of the project.

**2.1.7 AUXILIARY GENERATOR**

If the building is occupied during abatement, provide an auxiliary gasoline/diesel generator located outside the building in an area protected from the weather. In the event of a power failure, the generator must automatically start and supply power to a minimum of 50% of the negative air machines in operation.

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**2.1.1.8 SUPPLEMENTAL MAKE-UP AIR INLETS**

Provide, as needed for proper air flow in the regulated area, in a location approved by the VA, openings in the plastic sheeting to allow outside air to flow into the regulated area. Auxiliary makeup air inlets must be located as far from the negative air machines as possible, off the floor near the ceiling, and away from the barriers that separate the regulated area from the occupied clean areas. Cover the inlets with weighted flaps which will seal in the event of failure of the negative pressure system.

**2.1.1.9 TESTING THE SYSTEM**

The negative pressure system must be tested before any ACM is disturbed in any way. After the regulated area has been completely prepared, the decontamination units set up, and the negative air machines installed, start the units up one at a time. Demonstrate and document the operation and testing of the negative pressure system to the VA using smoke tubes and a negative pressure gauge. Testing must also be done at the start of each work shift.

**2.1.1.10 DEMONSTRATION OF THE NEGATIVE AIR PRESSURE SYSTEM**

The demonstration of the operation of the negative pressure system to the VA shall include, but not be limited to, the following:

- A. Plastic barriers and sheeting move lightly in toward the regulated area.
- B. Curtains of the decontamination units move in toward regulated area.
- C. There is a noticeable movement of air through the decontamination units. Use the smoke tube to demonstrate air movement from the clean room to the shower room to the equipment room to the regulated area.
- D. Use smoke tubes to demonstrate air is moving across all areas in which work is to be done. Use a differential pressure gauge to indicate a negative pressure of at least -0.02" across every barrier separating the regulated area from the rest of the building. Modify the system as necessary to meet the above requirements.

**2.1.1.11 USE OF SYSTEM DURING ABATEMENT OPERATIONS**

- A. Start units before beginning any disturbance of ACM occurs. After work begins, the units shall run continuously, maintaining 4 actual air changes per hour at a negative pressure differential of -0.02" water column gauge, for the duration of the work until a final visual clearance and final air clearance has been completed.  
The negative air machines shall not be shut down for the duration of the project unless authorized by the VA, in writing.
- B. Abatement work shall begin at a location farthest from the units and proceed towards them. If an electric failure occurs, the Competent Person shall stop all abatement work and immediately begin wetting all exposed asbestos materials for the duration of the power outage. Abatement work shall not resume until power is restored and all units are operating properly again.
- C. The negative air machines shall continue to run after all work is completed and until a final visual clearance and a final air clearance has been completed for that regulated area.

**2.1.1.12 DISMANTLING THE SYSTEM**

After completion of the final visual and final air clearance has been obtained by the VPIH/CIH, the units may be shut down. The units shall have been **completely decontaminated**, all pre-filters removed and

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disposed of as asbestos waste, asbestos labels attached and the units inlet/outlet sealed with 2 layers of 6 mil poly.

**2.2 CONTAINMENT BARRIERS AND COVERINGS IN THE REGULATED AREA**

**2.2.1 GENERAL**

Seal off the perimeter to the regulated area to completely isolate the regulated area from adjacent spaces. All surfaces in the regulated area must be covered to prevent contamination and to facilitate clean-up. Should adjacent areas become contaminated as a result of the work, shall immediately stop work and clean up the contamination at no additional cost to the VA. Provide firestopping and identify all fire barrier penetrations due to abatement work as specified in Section 2.2.8; FIRESTOPPING.

**2.2.2 PREPARATION PRIOR TO SEALING THE REGULATED AREA**

Place all tools, scaffolding, materials and equipment needed for working in the regulated area prior to erecting any plastic sheeting. All uncontaminated removable furniture, equipment and/or supplies shall be removed by the VA from the regulated area before commencing work. Any objects remaining in the regulated area shall be completely covered with 2 layers of 6-mil fire retardant poly sheeting and secured with duct tape. Lock out and tag out any HVAC/electrical systems in the regulated area.

**2.2.3 CONTROLLING ACCESS TO THE REGULATED AREA**

Access to the regulated area is allowed only through the personnel decontamination facility (PDF). All other means of access shall be eliminated and OSHA DANGER demarcation signs posted as required by OSHA. If the regulated area is adjacent to or within view of an occupied area, provide a visual barrier of 6 mil opaque fire retardant poly to prevent building occupant observation. If the adjacent area is accessible to the public, the barrier must be solid and capable of withstanding the negative pressure. Fire resistant barriers must be drywall/gypsum board. Danger signs must be posted as per OSHA. Any alternate method must be submitted for VA written approval.

**2.2.4 CRITICAL BARRIERS**

Completely separate any operations in the regulated area from adjacent areas using 2 layers of 6 mil fire retardant poly and duct tape. Individually seal with 2 layers of 6 mil poly and duct tape all HVAC openings into the regulated area. Individually seal all lighting fixtures, clocks, doors, windows, convectors, speakers, or any other objects/openings in the regulated area. Heat must be shut off any objects covered with poly.

**2.2.5 PRIMARY BARRIERS**

- A. Cover the regulated area with two layers of 6 mil fire retardant poly on the floors and two layers of 6 mil fire retardant poly on the walls and ceilings, unless otherwise directed in writing by the VA representative. Floor layers must form a right angle with the wall and turn up the wall at least 300 mm (12"). Seams must overlap at least 1800 mm (6') and must be spray glued and taped. Install sheeting so that layers can be removed independently from each other. Carpeting shall be covered with three layers of 6 mil poly. Corrugated cardboard sheets must be placed between the bottom and middle layers of poly. Mechanically support and seal with duct tape and glue all wall layers.

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- B. If stairs and ramps are covered with 6 mil plastic, two layers must be used. Provide 19 mm (3/4") exterior grade plywood treads held in place with duct tape/glue on the plastic. Do not cover rungs or rails with any isolation materials.

**2.2.6 SECONDARY BARRIERS**

A loose layer of 6 mil shall be used as a drop cloth to protect the primary layers from debris generated during the abatement. This layer shall be replaced as needed during the work minimally once per work day.

**2.2.7 EXTENSION OF THE REGULATED AREA**

If the enclosure of the regulated area is breached in any way that could allow contamination to occur, the affected area shall be included in the regulated area and constructed as per this section. Decontamination measures must be started immediately and continue until air monitoring indicates background levels are met.

**2.2.8 FIRESTOPPING**

- A. Through penetrations caused by cables, cable trays, pipes, sleeves must be firestopped with a fire-rated firestop system providing an air tight seal.
- B. Firestop materials that are not equal to the wall or ceiling penetrated shall be brought to the attention of the VA Representative. The contractor shall list all areas of penetration, the type of sealant used, and whether or not the location is fire rated. Any discovery of penetrations during abatement shall be brought to the attention of the VA representative immediately. All walls, floors and ceilings are considered fire rated unless otherwise determined by the VA Representative or Fire Marshall.
- C. Any visible openings whether or not caused by a penetration shall be reported by the Contractor to the VA Representative for a sealant system determination. Firestops shall meet ASTM E814 and UL 1479 requirements for the opening size, penetrant, and fire rating needed.

**2.3 MONITORING, INSPECTION AND TESTING**

**2.3.1 GENERAL**

- A. Perform throughout abatement work monitoring, inspection and testing inside and around the regulated area in accordance with the OSHA requirements and these specifications. The CPIH shall be responsible for and shall inspect and oversee the performance of the Contractor IH Technician. The IH Technician shall continuously inspect and monitor conditions inside the regulated area to ensure compliance with these specifications. In addition, the CPIH shall personally manage air sample collection, analysis, and evaluation for personnel, regulated area, and adjacent area samples to satisfy OSHA requirements. Additional inspection and testing requirements are also indicated in other parts of this specification.
- B. The VA will employ an independent industrial hygienist (VPIH/CIH) consultant and/or use its own IH to perform various services on behalf of the VA. The VPIH/CIH will perform the necessary monitoring, inspection, testing, and other support services to ensure that VA patients, employees, and visitors will not be adversely affected by the abatement work, and that the abatement work proceeds in accordance with these specifications, that the abated areas or abated buildings have been successfully decontaminated. The work of the VPIH/CIH consultant in no way relieves the Contractor from their responsibility to perform

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the work in accordance with contract/specification requirements, to perform continuous inspection, monitoring and testing for the safety of their employees, and to perform other such services as specified. The cost of the VPIH/CIH and their services will be borne by the VA except for any repeat of final inspection and testing that may be required due to unsatisfactory initial results. Any repeated final inspections and/or testing, if required, will be paid for by the Contractor.

- C. If fibers counted by the VPIH/CIH during abatement work, either inside or outside the regulated area, utilizing the NIOSH 7400 air monitoring method, exceed the specified respective limits, the Contractor shall stop work. The Contractor may request confirmation of the results by analysis of the samples by TEM. Request must be in writing and submitted to the VA's representative. Cost for the confirmation of results will be borne by the Contractor for both the collection and analysis of samples and for the time delay that may/does result for this confirmation. Confirmation sampling and analysis will be the responsibility of the CPIH with review and approval of the VPIH/CIH. An agreement between the CPIH and the VPIH/CIH shall be reached on the exact details of the confirmation effort, in writing, including such things as the number of samples, location, collection, quality control on-site, analytical laboratory, interpretation of results and any follow-up actions. This written agreement shall be co-signed by the IH's and delivered to the VA's representative.

**2.3.2 SCOPE OF SERVICES OF THE VPIH/CIH CONSULTANT**

- A. The purpose of the work of the VPIH/CIH is to: assure quality; adherence to the specification; resolve problems; prevent the spread of contamination beyond the regulated area; and assure clearance at the end of the project. In addition, their work includes performing the final inspection and testing to determine whether the regulated area or building has been adequately decontaminated. All air monitoring is to be done utilizing PCM/TEM. The VPIH/CIH will perform the following tasks:
1. Task 1: Establish background levels before abatement begins by collecting background samples. Retain samples for possible TEM analysis.
  2. Task 2: Perform continuous air monitoring, inspection, and testing outside the regulated area during actual abatement work to detect any faults in the regulated area isolation and any adverse impact on the surroundings from regulated area activities.
  3. Task 3: Perform unannounced visits to spot check overall compliance of work with contract/specifications. These visits may include any inspection, monitoring, and testing inside and outside the regulated area and all aspects of the operation except personnel monitoring.
  4. Task 4: Provide support to the VA representative such as evaluation of submittals from the Contractor, resolution of conflicts, interpret data, etc.
  5. Task 5: Perform, in the presence of the VA representative, final inspection and testing of a decontaminated regulated area at the conclusion of the abatement to certify compliance with all regulations and VA requirements/specifications.
  6. Task 6: Issue certificate of decontamination for each regulated area and project report.
- B. All documentation, inspection results and testing results generated by the VPIH/CIH will be available to the Contractor for information and



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consideration. The Contractor shall cooperate with and support the VPIH/CIH for efficient and smooth performance of their work.

- C. The monitoring and inspection results of the VPIH/CIH will be used by the VA to issue any Stop Removal orders to the Contractor during abatement work and to accept or reject a regulated area or building as decontaminated.

**2.3.3 MONITORING, INSPECTION AND TESTING BY CONTRACTOR CPIH**

The Contractor's CPIH is responsible for managing all monitoring, inspections, and testing required by these specifications, as well as any and all regulatory requirements adopted by these specifications. The CPIH is responsible for the continuous monitoring of all subsystems and procedures which could affect the health and safety of the Contractor's personnel. Safety and health conditions and the provision of those conditions inside the regulated area for all persons entering the regulated area is the exclusive responsibility of the Contractor/Competent Person. The person performing the personnel and area air monitoring inside the regulated area shall be an IH Technician, who shall be trained and shall have specialized field experience in air sampling and analysis. The IH Technician shall have a NIOSH 582 Course or equivalent and show proof. The IH Technician shall participate in the AIHA Asbestos Analysis Registry or participate in the Proficiency Analytic Testing program of AIHA for fiber counting quality control assurance. The IH Technician shall also be an accredited EPA/State Contractor/Supervisor and Building Inspector. The IH Technician shall have participated in five abatement projects collecting personal and area samples as well as responsibility for documentation. The analytic laboratory used by the Contractor to analyze the samples shall be AIHA accredited for asbestos PAT. A daily log documenting all OSHA requirements for air monitoring for asbestos in 29 CFR 1926.1101(f), (g) and Appendix A. This log shall be made available to the VA representative and the VPIH/CIH. The log will contain, at a minimum, information on personnel or area sampled, other persons represented by the sample, the date of sample collection, start and stop times for sampling, sample volume, flow rate, and fibers/cc. The CPIH shall collect and analyze samples for each representative job being done in the regulated area, i.e., removal, wetting, clean-up, and load-out. No fewer than two personal samples per shift shall be collected and one area sample per 1,000 square feet of regulated area where abatement is taking place and one sample per shift in the clean room area shall be collected. In addition to the continuous monitoring required, the CPIH will perform inspection and testing at the final stages of abatement for each regulated area as specified in the CPIH responsibilities.

**2.4 STANDARD OPERATING PROCEDURES**

The Contractor shall have established Standard Operating Procedures (SOP's) in printed form and loose leaf folder consisting of simplified text, diagrams, sketches, and pictures that establish and explain clearly the procedures to be followed during all phases of the work by the Contractor's personnel. The SOP's must be modified as needed to address specific requirements of this project and the specifications. The SOP's shall be submitted for review and approval prior to the start of any abatement work. The minimum topics and areas to be covered by the SOP's are:

- A. Minimum Personnel Qualifications

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- B. Emergency Action Plan/Contingency Plans and Arrangements
- C. Security and Safety Procedures
- D. Respiratory Protection/Personal Protective Equipment Program and Training
- E. Medical Surveillance Program and Recordkeeping
- F. Regulated Area Requirements - Containment Barriers/Isolation of Regulated Area
- G. Decontamination Facilities and Entry/Exit Procedures (PDF and W/EDF)
- H. Negative Pressure Systems Requirements
- I. Monitoring, Inspections, and Testing
- J. Removal Procedures for ACM
- K. Removal of Contaminated Soil (if applicable)
- L. Encapsulation Procedures for ACM
- M. Disposal of ACM waste/equipment
- N. Regulated Area Decontamination/Clean-up
- O. Regulated Area Visual and Air Clearance
- P. Project Completion/Closeout

**2.5 SUBMITTALS**

**2.5.1 PRE-START MEETING SUBMITTALS**

Submit to the VA a minimum of 14 days prior to the pre-start meeting the following for review and approval. Meeting this requirement is a prerequisite for the pre-start meeting for this project:

- A. Submit a detailed work schedule for the entire project reflecting contract documents and the phasing/schedule requirements from the CPM chart.
- B. Submit a staff organization chart showing all personnel who will be working on the project and their capacity/function. Provide their qualifications, training, accreditations, and licenses, as appropriate. Provide a copy of the "Certificate of Worker's Acknowledgment" and the "Affidavit of Medical Surveillance and Respiratory Protection" for each person.
- C. Submit Standard Operating Procedures developed specifically for this project, incorporating the requirements of the specifications, prepared, signed and dated by the CPIH.
- D. Submit the specifics of the materials and equipment to be used for this project with brand names, model numbers, performance characteristics, pictures/diagrams, and number available for the following:
  - 1. Supplied air system, if used, negative air machines, HEPA vacuums, air monitoring pumps, calibration devices, pressure differential monitoring device and emergency power generating system.
  - 2. Waste water filtration system, shower system, containment barriers.
  - 3. Encapsulants, surfactants, hand held sprayers, airless sprayers, glovebags, fire extinguishers.
  - 4. Respirators, protective clothing, personal protective equipment.
  - 5. Fire safety equipment to be used in the regulated area.
- E. Submit the name, location, and phone number of the approved landfill; proof/verification the landfill is approved for ACM disposal; the landfill's requirements for ACM waste; the type of vehicle to be used for transportation; and name, address, and phone number of subcontractor, if used. Proof of asbestos training for transportation personnel shall be provided.
- F. Submit required notifications and arrangements made with regulatory agencies having regulatory jurisdiction and the specific contingency/emergency arrangements made with local health, fire,

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ambulance, hospital authorities and any other notifications/arrangements.

- G. Submit the name, location and verification of the laboratory and personnel to be used for analysis of air and/or bulk samples. Air monitoring must be done in accordance with OSHA 29 CFR 1926.1101(f) and Appendix A.
- H. Submit qualifications verification: Submit the following evidence of qualifications. Make sure that all references are current and verifiable by providing current phone numbers and documentation.
  - 1. Asbestos Abatement Company: Project experience within the past 3 years; listing projects first most similar to this project: Project Name; Type of Abatement; Duration; Cost; Reference Name/Phone Number; Final Clearance; Completion Date
  - 2. List of project(s) halted by owner, A/E, IH, regulatory agency in the last 3 years: Project Name; Reason; Date; Reference Name/Number; Resolution
  - 3. List asbestos regulatory citations, penalties, damages paid and legal actions taken against the company in the last 3 years. Provide copies and all information needed for verification.
- I. Submit information on personnel: Provide a resume; address each item completely; copies of certificates, accreditations, and licenses. Submit an affidavit signed by the CPIH stating that all personnel submitted below have medical records in accordance with OSHA 29 CFR 1926.1101(m) and 29 CFR 1910.20 and that the company has implemented a medical surveillance program and maintains recordkeeping in accordance with the above regulations. Submit the phone number and doctor/clinic/hospital used for medical evaluations.
  - 1. CPIH: Name; years of abatement experience; list of projects similar to this one; certificates, licenses, accreditations for proof of AHERA/OSHA specialized asbestos training; professional affiliations; number of workers trained; samples of training materials; samples of SOP's developed; medical opinion; current respirator fit test.
  - 2. Competent Person(s)/Supervisor(s): Number; names; social security numbers; years of abatement experience as Competent Person/Supervisor; list of similar projects as Competent Person/Supervisor; as a worker; certificates, licenses, accreditations; proof of AHERA/OSHA specialized asbestos training; maximum number of personnel supervised on a project; medical opinion; current respirator fit test.
  - 3. Workers: Numbers; names; social security numbers; years of abatement experience; certificates, licenses, accreditations; training courses in asbestos abatement and respiratory protection; medical opinion; current respirator fit test.
- J. Submit copies of State license for asbestos abatement; copy of insurance policy, including exclusions with a letter from agent stating in plain english the coverage provided and the fact that asbestos abatement activities are covered by the policy; copy of SOP's incorporating the requirements of this specification; information on who provides your training, how often; who provides medical surveillance, how often; who does and how is air monitoring conducted; a list of references of independent laboratories/IH's familiar with your air monitoring and standard operating procedures; copies of monitoring results of the five referenced projects listed and analytical method(s) used.

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- K. Rented equipment must be decontaminated prior to returning to the rental agency.
- L. Submit, before the start of work, the manufacturer's technical data for all types of encapsulants and the MSDS. Provide application instructions also.

**2.5.2 SUBMITTALS DURING ABATEMENT**

- A. The Competent Person shall maintain and submit a daily log at the regulated area documenting the dates and times of the following: purpose, attendees and summary of meetings; all personnel entering/exiting the regulated area; document and discuss the resolution of unusual events such as barrier breaching, equipment failures, emergencies, and any cause for stopping work; representative air monitoring and results/TWA's/EL's. Submit this information daily to the VPIH/CIH.
- B. The CPIH shall document and maintain the inspection and approval of the regulated area preparation prior to start of work and daily during work.
  - 1. Removal of any poly barriers.
  - 2. Visual inspection/testing by the CPIH prior to application of lockdown.
  - 3. Packaging and removal of ACM waste from regulated area.
  - 4. Disposal of ACM waste materials; copies of Waste Shipment Records/landfill receipts to the VA's representative on a weekly basis.

**2.5.3 SUBMITTALS AT COMPLETION OF ABATEMENT**

The CPIH shall submit a project report consisting of the daily log book requirements and documentation of events during the abatement project including Waste Shipment Records signed by the landfill's agent. The report shall include a certificate of completion, signed and dated by the CPIH, in accordance with Attachment #1. All clearance and perimeter samples must be submitted. The VA Representative will retain the abatement report after completion of the project.

**2.6 ENCAPSULANTS**

**2.6.1 TYPES OF ENCAPSULANTS**

- A. The following four types of encapsulants, if used, must comply with performance requirements as stated in paragraph 2.6.2:
  - 1. Removal encapsulant - used as a wetting agent to remove ACM.
  - 2. Bridging encapsulant - provides a tough, durable coating on ACM.
  - 3. Penetrating encapsulant - penetrates/encapsulates ACM at least 13 mm (1/2").
  - 4. Lockdown encapsulant - seals microscopic fibers on surfaces after ACM removal.

**2.6.2 PERFORMANCE REQUIREMENTS**

Encapsulants shall meet the latest requirements of EPA; shall not contain toxic or hazardous substances; or solvents; and shall comply with the following performance requirements:

- A. General Requirements for all Encapsulants:
  - 1. ASTM E84: Flame spread of 25; smoke emission of 50.
  - 2. University of Pittsburgh Protocol: Combustion Toxicity; zero mortality.
  - 3. ASTM C732: Accelerated Aging Test; Life Expectancy - 20 years.
  - 4. ASTM E96: Permeability - minimum of 0.4 perms.

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**B. Bridging/Penetrating Encapsulants:**

1. ASTM E736: Cohesion/Adhesion Test - 24 kPa (50 lbs/ft<sup>2</sup>).
2. ASTM E119: Fire Resistance - 3 hours (Classified by UL for use on fibrous/cementitious fireproofing).
3. ASTM D2794: Gardner Impact Test; Impact Resistance - minimum 11.5 kg-mm (43 in/lb).
4. ASTM D522: Mandrel Bend Test; Flexibility - no rupture or cracking.

**C. Lockdown Encapsulants:**

1. ASTM E119: Fire resistance - 3 hours (tested with fireproofing over encapsulant applied directly to steel member).
2. ASTM E736: Bond Strength - 48 kPa (100 lbs/ft<sup>2</sup>) (test compatibility with cementitious and fibrous fireproofing).
3. In certain situations, encapsulants may have to be applied to hot pipes/equipment. The encapsulant must be able to withstand high temperatures without cracking or off-gassing any noxious vapors during application.

**2.6.3 CERTIFICATES OF COMPLIANCE**

The Contractor shall submit to the VA representative certification from the manufacturer indicating compliance with performance requirements for encapsulants when applied according to manufacturer recommendations.

**PART 3 - EXECUTION**

**3.1 PRE-ABATEMENT ACTIVITIES**

**3.1.1 PRE-ABATEMENT MEETING**

The VA representative, upon receipt, review, and substantial approval of all pre-abatement submittals and verification by the CPIH that all materials and equipment required for the project are on the site, will arrange for a pre-abatement meeting between the Contractor, the CPIH, Competent Person(s), the VA representative(s), and the VPIH/CIH. The purpose of the meeting is to discuss any aspect of the submittals needing clarification or amplification and to discuss any aspect of the project execution and the sequence of the operation. The Contractor shall be prepared to provide any supplemental information/documentation to the VA's representative regarding any submittals, documentation, materials or equipment. Upon satisfactory resolution of any outstanding issues, the VA's representative will issue a written order to proceed to the Contractor. No abatement work of any kind described in the following provisions shall be initiated prior to the VA written order to proceed.

**3.1.2 PRE-ABATEMENT INSPECTIONS AND PREPARATIONS**

Before any work begins on the construction of the regulated area, the Contractor will:

- A. Conduct a space-by-space inspection with an authorized VA representative and prepare a written inventory of all existing damage in those spaces where asbestos abatement will occur. Still or video photography may be used to supplement the written damage inventory. Document will be signed and certified as accurate by both parties.
- B. The VA Representative, the Contractor, and the VPIH/CIH must be aware of 10/95 A/E Quality Alert indicating the failure to identify asbestos in the areas listed. Make sure these areas are looked at/reviewed on the project: Lay-in ceilings concealing ACM; ACM behind walls/windows from previous renovations; inside chases/walls; transite piping/ductwork/sheets; behind radiators; roofing materials; below

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window sills; water/sewer lines; electrical conduit coverings; crawl spaces (previous abatement contamination); flooring/mastic covered by carpeting/new flooring; exterior insulated wall panels; on underground fuel tanks; steam line trench coverings.

- C. Ensure that all furniture, machinery, equipment, curtains, drapes, blinds, and other movable objects required to be removed from the regulated area have been cleaned and removed or properly protected from contamination. The VAMC shall remove moveable objects from the work areas before asbestos abatement activities begin.
- D. Remove and dispose of carpeting from floors in the regulated area.
- E. Inspect existing firestopping in the regulated area. Correct as needed.

**3.1.3 PRE-ABATEMENT CONSTRUCTION AND OPERATIONS**

- A. Perform all preparatory work for the first regulated area in accordance with the approved work schedule and with this specification.
- B. Upon completion of all preparatory work, the CPIH will inspect the work and systems and will notify the VA's representative when the work is completed in accordance with this specification. The VA's representative may inspect the regulated area and the systems with the VPIH/CIH and may require that upon satisfactory inspection, the Contractor's employees perform all major aspects of the approved SOP's, especially worker protection, respiratory systems, contingency plans, decontamination procedures, and monitoring to demonstrate satisfactory operation. The operational systems for respiratory protection and the negative pressure system shall be demonstrated for proper performance.
- C. The CPIH shall document the pre-abatement activities described above and deliver a copy to the VA's representative.
- D. Upon satisfactory inspection of the installation of and operation of systems the VA's representative will notify the Contractor in writing to proceed with the asbestos abatement work in accordance with this specification and all applicable regulations.

**3.2 REGULATED AREA PREPARATIONS**

- A. Post OSHA DANGER signs meeting the specifications of OSHA 29 CFR 1926.1101 at any location and approaches to the regulated area where airborne concentrations of asbestos may exceed ambient background levels. Signs shall be posted at a distance sufficiently far enough away from the regulated area to permit any personnel to read the sign and take the necessary measures to avoid exposure. Additional signs will be posted following construction of the regulated area enclosure.
- B. Shut down and lock out electric power to the regulated area. Provide temporary power and lighting. Insure safe installation including GFCI of temporary power sources and equipment by compliance with all applicable electrical code requirements and OSHA requirements for temporary electrical systems. Electricity shall be provided by the VA.
- C. Shut down and lock out heating, cooling, and air conditioning system (HVAC) components that are in, supply or pass through the regulated area. Investigate the regulated area and agree on pre-abatement condition with the VA's representative. Seal all intake and exhaust vents in the regulated area with duct tape and 2 layers of 6-mil poly. Also, seal any seams in system components that pass through the regulated area. Remove all contaminated HVAC system filters and place in labeled 6-mil polyethylene disposal bags for staging and eventual disposal as asbestos waste.

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- D. The Contractor shall provide sanitary facilities for abatement personnel and maintain them in a clean and sanitary condition throughout the abatement project.
- E. The VA will provide water for abatement purposes. The Contractor shall connect to the existing VA system. The service to the shower(s) shall be supplied with backflow prevention.
- F. Pre-clean all movable objects within the regulated area using a HEPA filtered vacuum and/or wet cleaning methods as appropriate. After cleaning, these objects shall be removed from the regulated area and carefully stored in an uncontaminated location. Drapes, clothing, upholstered furniture and other fabric items should be disposed of as asbestos contaminated waste. Cleaning these asbestos contaminated items utilizing HEPA vacuum techniques and off-premises steam cleaning is very difficult and cannot guarantee decontamination. Since adequate cleaning of contaminated fabrics is difficult, the VA will determine whether this option is an appropriate one. Carpeting will be disposed of prior to abatement if in the regulated area. The contractor shall be responsible for removal and disposal of the carpet before asbestos abatement activities begin.
- G. Pre-clean all fixed objects in the regulated area using HEPA filtered vacuums and/or wet cleaning techniques as appropriate. Careful attention must be paid to machinery behind grills or gratings where access may be difficult but contamination may be significant. Also, pay particular attention to wall, floor and ceiling penetration behind fixed items. After precleaning, enclose fixed objects with 2 layers of 6-mil poly and seal securely in place with duct tape. Objects (e.g., permanent fixtures, shelves, electronic equipment, laboratory tables, sprinklers, alarm systems, closed circuit TV equipment and computer cables) which must remain in the regulated area and that require special ventilation or enclosure requirements should be designated here along with specified means of protection. Contact the manufacturer for special protection requirements. The contractor is responsible for pre-cleaning. Control panels, gauges etc., in the regulated area may require VA access during abatement. These shall be designated and enclosures constructed with access flaps sealed with waterproof tape.
- H. Pre-clean all surfaces in the regulated area using HEPA filtered vacuums and/or wet cleaning methods as appropriate. Do not use any methods that would raise dust such as dry sweeping or vacuuming with equipment not equipped with HEPA filters. Do not disturb asbestos-containing materials during this pre-cleaning phase.

**3.3 CONTAINMENT BARRIERS AND COVERINGS FOR THE REGULATED AREA GENERAL:**

Follow requirements of Section 2.2 - Containment Barriers and Coverings.

**3.4 REMOVAL OF ACM**

**3.4.1 WETTING ACM**

- A. Use amended water for the wetting of ACM prior to removal. The Competent Person shall assure the wetting of ACM meets the definition of "adequately wet" in the EPA NESHAP's regulation and OSHA's "wet methods" for the duration of the project. A removal encapsulant may be used instead of amended water with written approval of the VA's representative.
- B. Amended Water: Provide water to which a surfactant has been added shall be used to wet the ACM and reduce the potential for fiber release during disturbance of ACM. The mixture must be equal to or greater than

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the wetting provided by water amended by a surfactant consisting one ounce of 50% polyoxyethylene ester and 50% polyoxyethylene ether mixed with 5 gallons (19L) of water.

- C. Removal Encapsulant: Provide a penetrating encapsulant designed specifically for the removal of ACM. The material must, when used, result in adequate wetting of the ACM and retard fiber release during removal.

**3.4.2 SECONDARY BARRIER AND WALKWAYS**

- A. Install as a drop cloth a 6 mil poly sheet at the beginning of each work shift where removal is to be done during that shift. Completely cover floors and any walls within 10 feet (3M) of the area where work is to done. Secure the secondary barrier with duct tape to prevent debris from getting behind it. Remove the secondary barrier at the end of the shift or as work in the area is completed. Keep residue on the secondary barrier wetted. When removing, fold inward to prevent spillage and place in a disposal bag.
- B. Install walkways using 6 mil black poly between the regulated area and the decontamination facilities (PDF and W/EDF) to protect the primary layers from contamination and damage. Install the walkways at the beginning of each shift and remove at the end of each shift.

**3.4.3 WET REMOVAL OF ACM**

- A. Adequately and thoroughly wet the ACM to be removed prior to removal to reduce/prevent fiber release to the air. Adequate time must be allowed for the amended water to saturate the ACM. Abatement personnel must not disturb dry ACM. Use a fine spray of amended water or removal encapsulant. Saturate the material sufficiently to wet to the substrate without causing excessive dripping. The material must be sprayed repeatedly/continuously during the removal process in order to maintain adequately wet conditions. Removal encapsulants must be applied in accordance with the manufacturer's written instructions. Perforate or carefully separate, using wet methods, an outer covering that is painted or jacketed in order to allow penetration and wetting of the material. Where necessary, carefully remove covering while wetting to minimize fiber release. **In no event shall dry removal occur except in the case of electrical hazards or a greater safety issue is possible!**
- B. If ACM does not wet well with amended water due to coating or jacketing, remove as follows:
  - 1. Mist work area continuously with amended water whenever necessary to reduce airborne fiber levels.
  - 2. Remove saturated ACM in small sections. Do not allow material to dry out. As material is removed, bag material while still wet into disposal bags. Twist tightly the bag neck, bend over (gooseneck) and seal with a minimum of three tight wraps of duct tape. Clean /decontaminate the outside of any residue and move to washdown station adjacent to W/EDF.
  - 3. Fireproofing or Architectural Finish on Scratch Coat: Spray with a fine mist of amended water or removal encapsulant. Allow time for saturation to the substrate. Do not oversaturate causing excess dripping. Scrape material from substrate. Remove material in manageable quantities and control falling to staging or floor. If the falling distance is over 20 feet (6M), use a drop chute to contain material through descent. Remove residue remaining on the scratch coat after scraping is done using a stiff bristle hand brush. If a removal encapsulant is used, remove residue completely



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- before the encapsulant dries. Re-wet the substrate as needed to prevent drying before the residue is removed.
4. Fireproofing or Architectural Finish on Wire Lath: Spray with a fine mist of amended water or removal encapsulant. Allow time to completely saturate the material. Do not oversaturate causing excess dripping. If the surface has been painted or otherwise coated, cut small holes as needed and apply amended water or removal encapsulant from above. Cut saturated wire lath into 2' x 6' (50mm x 150mm) sections and cut hanger wires. Roll up complete with ACM, cover in burlap and hand place in disposal bag. Do not drop to floor. After removal of lath/ACM, remove any overspray on decking and structure using stiff bristle nylon brushes. Depending on hardness of overspray, scrapers may be needed for removal.
  5. Pipe/Tank/Vessel/Boiler Insulation: Remove the outer layer of wrap while spraying with amended water in order to saturate the ACM. Spray ACM with a fine mist of amended water or removal encapsulant. Allow time to saturate the material to the substrate. Cut bands holding pre-formed pipe insulation sections. Slit jacketing at the seams, remove and hand place in a disposal bag. Do not allow dropping to the floor. Remove molded fitting insulation/mud in large pieces and hand place in a disposal bag. Remove any residue on pipe or fitting with a stiff bristle nylon brush. In locations where pipe fitting insulation is removed from fibrous glass or other non-asbestos insulated straight runs of pipe, remove fibrous material at least 6" from the point it contacts the ACM.

**3.4.4 WET REMOVAL OF AMOSITE**

ACM with a fine mist of amended water or removal encapsulant. Allow time to saturate the material to the substrate. Cut bands holding pre-formed pipe insulation sections. Slit jacketing at the seams, remove and hand place in a disposal bag. Do not allow dropping to the floor. Remove molded fitting insulation/mud in large pieces and hand place in a disposal bag. Remove any residue on pipe or fitting with a stiff bristle nylon brush. In locations where pipe fitting insulation is removed from fibrous glass or other non-asbestos insulated straight runs of pipe, remove fibrous material at least 6" from the point it contacts the ACM.

**3.4.4 WET REMOVAL OF AMOSITE**

- A. The steam and condensate pipe insulation on the 8<sup>th</sup> and 10<sup>th</sup> floors contain amosite ACM which will require local exhaust ventilation and collection as described below, in addition to wet removal.
- B. Provide local exhaust ventilation and collection systems to assure collection of amosite fibers at the point of generation. A 300 mm (12") flexible rigid non-collapsing duct shall be located no more than 600 mm (2') from any scraping/brushing activity. Primary filters must be replaced every 30 minutes on the negative air machines. Each scraping/brushing activity must have a negative air machine devoted to it. For pre-molded pipe insulation or cutting wire lathe attach a 1200 mm (4') square flared end piece on the intake of the duct. Support the duct horizontally at a point 600 mm (2') below the work to effect capture. One person in the crew shall be assigned to operate the duct collection system on a continual basis.
- C. Amosite does not wet well with amended water. Submit full information/documentation on the wetting agent proposed prior to start

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for review and approval by the VA Representative. Insure that the material is worked on in small sections and is thoroughly and continuously wetted. Package as soon as possible while wet. Remove as required.

**3.4.5 REMOVAL OF ACM/DIRT FLOORS AND OTHER SPECIAL PROCEDURES**

Not Applicable

**3.5 LOCKDOWN ENCAPSULATION**

**3.5.1 GENERAL**

Lockdown encapsulation is an integral part of the ACM removal. At the conclusion of ACM removal and after successful clearance air testing, all surfaces shall be encapsulated with a bridging encapsulant.

**3.5.2 DELIVERY AND STORAGE**

Deliver materials to the job site in original, new and unopened containers bearing the manufacturer's name and label as well as the following information: name of material, manufacturer's stock number, date of manufacture, thinning instructions, application instructions and the MSDS for the material.

**3.5.3 WORKER PROTECTION**

Before beginning work with any material for which an MSDS has been submitted, provide workers with any required personal protective equipment. The required personal protective equipment shall be used whenever exposure to the material might occur. In addition to OSHA/specification requirements for respiratory protection, a paint pre-filter and an organic vapor cartridge, at a minimum, shall used in addition to the HEPA filter when a solvent based encapsulant is used. The CPIH shall be responsible for provision of adequate respiratory protection.

**3.5.4 ENCAPSULATION OF SCRATCH COAT PLASTER OR PIPING**

- A. Apply two coats of encapsulant to the scratch coat plaster or piping after all ACM has been removed. Apply in strict accordance with the manufacturer's instructions. Any deviation from the instructions must be approved by the VA's representative in writing prior to commencing the work.
- B. Apply the encapsulant with an airless sprayer at a pressure and using a nozzle orifice as recommended by the manufacturer. Apply the first coat while the while the scratch coat is still damp from the asbestos removal process, after passing the visual inspection. If the surface has been allowed to dry, wet wipe or HEPA vacuum prior to spraying with encapsulant. Apply a second coat over the first coat in strict conformance with the manufacturer's instructions. Color the encapsulant and contrast the color in the second coat so that visual confirmation of completeness and uniform coverage of each coat is possible. Adhere to the manufacturer's instructions for coloring. At the completion of the encapsulation, the surface must be a uniform third color produced by the mixture.

**3.5.5 SEALING EXPOSED EDGES**

Seal edges of ACM exposed by removal work which is inaccessible, such as a sleeve, wall penetration, etc., with two coats of encapsulant. Prior to sealing, permit the exposed edges to dry completely to permit penetration of the encapsulant. Apply in accordance with 3.5.4 (B).

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**3.6 DISPOSAL OF ACM WASTE MATERIALS**

**3.6.1 GENERAL**

Dispose of waste ACM and debris which is packaged in accordance with these specifications, OSHA, EPA and DOT. The landfill requirements for packaging must also be met. Disposal shall be done at an approved landfill. Disposal of non-friable ACM shall be done in accordance with applicable regulations.

**3.6.2 PROCEDURES**

- A. Asbestos waste shall be packaged and moved through the W/EDF into a covered transport container in accordance with procedures in this specification. Waste shall be double-bagged prior to disposal. Wetted waste can be very heavy. Bags shall not be overfilled. Bags shall be securely sealed to prevent accidental opening and/or leakage. The top shall be tightly twisted and goosenecked prior to tightly sealing with at least three wraps of duct tape. Ensure that unauthorized persons do not have access to the waste material once it is outside the regulated area. All transport containers must be covered at all times when not in use. NESHAP's signs must be on containers during loading and unloading. Material shall not be transported in open vehicles. If drums are used for packaging, the drums shall be labeled properly and shall not be re-used.
- B. Waste Load Out: Waste load out shall be done in accordance with the procedures in W/EDF Decontamination Procedures. Bags shall be decontaminated on exterior surfaces by wet cleaning and/or HEPA vacuuming before being placed in the second bag.
- C. Asbestos waste with sharp edged components, i.e., nails, screws, lath, strapping, tin sheeting, jacketing, metal mesh, etc., which might tear poly bags shall be wrapped securely in burlap before packaging and, if needed, use a poly lined fiber drum as the second container, prior to disposal.

**3.7 PROJECT DECONTAMINATION**

**3.7.1 GENERAL**

- A. The entire work related to project decontamination shall be performed under the close supervision and monitoring of the CPIH.
- B. If the asbestos abatement work is in an area which was contaminated prior to the start of abatement, the decontamination will be done by cleaning the primary barrier poly prior to its removal and cleanings of the surfaces of the regulated area after the primary barrier removal.
- C. If the asbestos abatement work is in an area which was uncontaminated prior to the start of abatement, the decontamination will be done by cleaning the primary barrier poly prior to its removal, thus preventing contamination of the building when the regulated area critical barriers are removed.

**3.7.2 REGULATED AREA CLEARANCE**

Air testing and other requirements which must be met before release of the Contractor and re-occupancy of the regulated area space are specified in Final Testing Procedures.

**3.7.3 WORK DESCRIPTION**

Decontamination includes the clearance of the air in the regulated area and the decontamination and removal of the enclosures/facilities installed prior to the abatement work including primary/critical barriers, PDF and W/EDF facilities, and negative pressure systems.

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**3.7.4 PRE-DECONTAMINATION CONDITIONS**

- A. Before decontamination starts, all ACM waste from the regulated area shall be removed, all waste collected and removed, and the loose 6 mil layer of poly removed and disposed of along with any gross debris generated by the work.
- B. At the start of decontamination, the following shall be in place:
  - 1. Primary barriers consisting of 2 layers of 6 mil poly on the floor, ceiling and 6 mil poly on the walls.
  - 2. Critical barriers consisting of 2 layers of 6 mil poly which is the sole barrier between the regulated area and openings to the rest of the building or outside.
  - 4. Decontamination facilities for personnel and equipment in operating condition and the negative pressure system in operation.

**3.7.5 FIRST CLEANING**

Carry out a first cleaning of all surfaces of the regulated area including items of remaining poly sheeting, tools, scaffolding, ladders/staging by wet methods and/or HEPA vacuuming. Do not use dry dusting/sweeping methods. Use each surface of a cleaning cloth one time only and then dispose of as contaminated waste. Continue this cleaning until there is no visible residue from abated surfaces or poly or other surfaces. Remove all filters in the air handling system and dispose of as ACM waste in accordance with these specifications. The negative pressure system shall remain in operation during this time. If determined by the CPIH/VPIH/CIH additional cleaning(s) may be needed. Three (3) cleaning followed by three (3) 12-hour settling periods shall be required for all full-containment gross removal areas.

**3.7.6 PRE-CLEARANCE INSPECTION AND TESTING**

The CPIH and VPIH/CIH will perform a thorough and detailed visual inspection at the end of the cleaning to determine whether there is any visible residue in the regulated area. If the visual inspection is acceptable, the CPIH will perform pre-clearance sampling using aggressive clearance as detailed in 40 CFR 763 Subpart E (AHERA) Appendix A (III)(B)(7)(d). If the sampling results show values below 0.01 f/cc, then the Contractor shall notify the VA's representative of the results with a brief report from the CPIH documenting the inspection and sampling results and a statement verifying that the regulated area is ready for lockdown encapsulation. The VA reserves the right to utilize their own VPIH/CIH to perform a pre-clearance inspection and testing for verification.

**3.7.7 LOCKDOWN ENCAPSULATION OF ABATED SURFACES**

With the express written permission of the VA's representative, perform lockdown encapsulation of all surfaces from which asbestos was abated in accordance with the procedures in this specification. Negative pressure shall be maintained in the regulated area during the lockdown application.

**3.8 FINAL VISUAL INSPECTION AND AIR CLEARANCE TESTING**

**3.8.1 GENERAL**

Notify the VA representative 24 hours in advance for the performance of the final visual inspection and testing. The final visual inspection and testing will be performed by the VPIH/CIH starting after the final cleaning.

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**3.8.2 FINAL VISUAL INSPECTION**

Final visual inspection will include the entire regulated area, the PDF, all poly sheeting, seals over HVAC openings, doorways, windows, and any other openings. If any debris, residue, dust or any other suspect material is detected, the final cleaning shall be repeated at no cost to the VA. Dust/material samples may be collected and analyzed at no cost to the VA at the discretion of the VPIH/CIH to confirm visual findings. When the regulated area is visually clean the final testing can be done.

**3.8.3 FINAL AIR CLEARANCE TESTING**

- A. After an acceptable final visual inspection by the VPIH/CIH and VA Representative AE Project Engineer, the VPIH/CIH will perform the final testing. Air samples will be collected and analyzed in accordance with procedures for AHERA in this specification. If work is less than 260 lf/160 sf, 5 PCM samples may be collected for clearance. If work is equal to or more than 260 lf/160 sf, TEM sampling shall be done for clearance. TEM analysis shall be done in accordance with procedures in this specification. If the release criteria are not met, the Contractor shall repeat the final cleaning and continue decontamination procedures until clearance is achieved. All **Additional inspection and testing costs will be borne by the Contractor.**
- B. If release criteria are met, proceed to perform the abatement closeout and to issue the certificate of completion in accordance with these specifications.

**3.8.4 FINAL AIR CLEARANCE PROCEDURES**

- A. Contractor's Release Criteria: Work in a regulated area is complete when the regulated area is visually clean and airborne fiber levels have been reduced to or below 0.01 f/cc as measured with PCM methods and 70 s/mm<sup>2</sup> with TEM methods.
- B. Air Monitoring and Final Clearance Sampling: To determine if the elevated airborne fiber counts encountered during abatement operations have been reduced to the specified level, the VPIH/CIH will secure samples and analyze them according to the following procedures:
  1. Fibers Counted: "Fibers" referred to in this section shall be either all fibers regardless of composition as counted in the NIOSH 7400 PCM method or asbestos fibers counted using the AHERA TEM method.
  2. Aggressive Sampling: All final air testing samples shall be collected using aggressive sampling techniques except where soil is not encapsulated or enclosed. Samples will be collected on 0.8µ MCE filters for PCM analysis and 0.45µ Polycarbonate filters for TEM. A minimum of 1200 Liters of air shall be collected for clearance samples. Before pumps are started, initiate aggressive sampling as detailed in 40 CFR 763 Subpart E (AHERA) Appendix A (III)(B)(7)(d). Air samples will be collected in areas subject to normal air circulation away from corners, obstructed locations, and locations near windows, doors, or vents. After air sampling pumps have been shut off, circulating fans shall be shut off. The negative pressure system shall continue to operate.

**3.8.5 CLEARANCE SAMPLING USING PCM - LESS THAN 260LF/160SF:**

- A. The VPIH/CIH will perform clearance samples as indicated by the specification.
- B. The NIOSH 7400 PCM method will be used for clearance sampling with a minimum collection volume of 1200 Liters of air. A minimum of 5 PCM

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clearance samples shall be collected. All samples must be equal to or less than 0.01 f/cc to clear the regulated area.

**3.8.6 CLEARANCE SAMPLING USING TEM - EQUAL TO OR MORE THAN 260LF/160SF: TEM**

Clearance requires 13 samples be collected; 5 inside the regulated area; 5 outside the regulated area; and 3 field blanks.

**3.8.7 LABORATORY TESTING OF PCM CLEARANCE SAMPLES**

The services of an AIHA accredited laboratory will be employed by the VA to perform analysis for the air samples. Samples will be sent daily by the VPIH/CIH so that verbal/faxed reports can be received within 24 hours. A complete record, certified by the laboratory, of all air monitoring tests and results will be furnished to the VA's representative and the Contractor.

**3.8.8 LABORATORY TESTING OF TEM SAMPLES**

Samples shall be sent by the VPIH/CIH to an accredited laboratory for analysis by TEM. Verbal/faxed results from the laboratory shall be available within 24 hours after receipt of the samples. A complete record, certified by the laboratory, of all TEM results shall be furnished to the VA's representative and the Contractor.

**3.9 ABATEMENT CLOSEOUT AND CERTIFICATE OF COMPLIANCE**

**3.9.1 COMPLETION OF ABATEMENT WORK**

After thorough decontamination, seal negative air machines with 2 layers of 6 mil poly and duct tape to form a tight seal at the intake/outlet ends before removal from the regulated area. Complete asbestos abatement work upon meeting the regulated area visual and air clearance criteria and fulfilling the following:

- A. Remove all equipment and materials from the project area.
- B. Dispose of all packaged ACM waste as required.
- C. Repair or replace all interior finishes damaged during the abatement work, as required.
- D. Fulfill other project closeout requirements as required in this specification.

**3.9.2 CERTIFICATE OF COMPLETION BY CONTRACTOR**

The CPIH shall complete and sign the "Certificate of Completion" in accordance with Attachment 1 at the completion of the abatement and decontamination of the regulated area.

**3.9.3 WORK SHIFTS**

All work shall be done during administrative hours (8:00 AM to 4:30 PM) Monday -Friday excluding Federal Holidays. Any change in the work schedule must be approved in writing by the VA Representative. Work may be performed off-hours, nights and weekends at no additional cost to the VAMC due to the complexity of this project and the need to shutdown mechanical systems for isolation.

**3.9.4 RE-INSULATION**

If required as part of the contract, replace all asbestos containing insulation/fire-proofing with suitable non-asbestos material. Provide MSDS's for all replacement materials. Refer to Section 23 07 11, HVAC, PLUMBING, AND BOILER PLANT INSULATION.

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ATTACHMENT #1

CERTIFICATE OF COMPLETION

DATE:  
PROJECT NAME:  
VAMC/ADDRESS:

1. I certify that I have personally inspected, monitored and supervised the abatement work of (specify regulated area or Building):  
which took place from / / / to / /
2. That throughout the work all applicable requirements/regulations and the VA's specifications were met.
3. That any person who entered the regulated area was protected with the appropriate personal protective equipment and respirator and that they followed the proper entry and exit procedures and the proper operating procedures for the duration of the work.
4. That all employees of the Contractor engaged in this work were trained in respiratory protection, were experienced with abatement work, had proper medical surveillance documentation, were fit-tested for their respirator, and were not exposed at any time during the work to asbestos without the benefit of appropriate respiratory protection.
5. That I performed and supervised all inspection and testing specified and required by applicable regulations and VA specifications.
6. That the conditions inside the regulated area were always maintained in a safe and healthy condition and the maximum fiber count never exceeded 0.5 f/cc, except as described below.
7. That the negative pressure system was installed, operated and maintained in order to provide a minimum of 4 actual air changes per hour with a continuous -0.02" of water column pressure.

Signature/Date:

Signature/Date:

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**ATTACHMENT #2**

**CERTIFICATE OF WORKER'S ACKNOWLEDGMENT**

PROJECT NAME:

DATE:

PROJECT ADDRESS:

ABATEMENT CONTRACTOR'S NAME:

WORKING WITH ASBESTOS CAN BE HAZARDOUS TO YOUR HEALTH. INHALING ASBESTOS HAS BEEN LINKED WITH VARIOUS TYPES OF CANCERS. IF YOU SMOKE AND INHALE ASBESTOS FIBERS YOUR CHANCES OF DEVELOPING LUNG CANCER IS GREATER THAN THAT OF THE NON-SMOKING PUBLIC.

Your employer's contract with the owner for the above project requires that: You must be supplied with the proper personal protective equipment including an adequate respirator and be trained in its use. You must be trained in safe and healthy work practices and in the use of the equipment found at an asbestos abatement project. You must receive/have a current medical examination for working with asbestos. These things shall be provided at no cost to you. By signing this certificate you are indicating to the owner that your employer has met these obligations.

RESPIRATORY PROTECTION: I have been trained in the proper use of respirators and have been informed of the type of respirator to be used on the above indicated project. I have a copy of the written Respiratory Protection Program issued by my employer. I have been provided for my exclusive use, at no cost, with a respirator to be used on the above indicated project.

TRAINING COURSE: I have been trained by a third party, State/EPA accredited trainer in the requirements for an AHERA/OSHA Asbestos Abatement Worker training course, 32 hours minimum duration. I currently have a valid State accreditation certificate. The topics covered in the course include, as a minimum, the following:

- Physical Characteristics and Background Information on Asbestos
- Potential Health Effects Related to Exposure to Asbestos
- Employee Personal Protective Equipment
- Establishment of a Respiratory Protection Program
- State of the Art Work Practices
- Personal Hygiene
- Additional Safety Hazards
- Medical Monitoring
- Air Monitoring
- Relevant Federal, State and Local Regulatory Requirements, Procedures, and Standards
- Asbestos Waste Disposal

MEDICAL EXAMINATION: I have had a medical examination within the past 12 months which was paid for by my employer. This examination included: health history, occupational history, pulmonary function test, and may have included a chest x-ray evaluation. The physician issued a positive written opinion after the examination.

Signature:

Printed Name:

Social Security Number:

Witness:



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**ATTACHMENT #3**

**AFFIDAVIT OF MEDICAL SURVEILLANCE, RESPIRATORY PROTECTION AND  
TRAINING/ACCREDITATION**

VA PROJECT NAME AND NUMBER:

VA MEDICAL FACILITY:

ABATEMENT CONTRACTOR'S NAME AND ADDRESS:

1. I verify that the following individual

Name:

Social Security Number:

who is proposed to be employed in asbestos abatement work associated with the above project by the named. Contractor, is included in a medical surveillance program in accordance with 29 CFR 1926.1101(m), and that complete records of the medical surveillance program as required by 29 CFR 1926.1101(m)(n) and 29 CFR 1910.20 are kept at the offices of the Contractor at the following address.

Address:

2. I verify that this individual has been trained, fit-tested and instructed in the use of all appropriate respiratory protection systems and that the person is capable of working in safe and healthy manner as expected and required in the expected work environment of this project.
3. I verify that this individual has been trained as required by 29 CFR 1926.1101(k). This individual has also obtained a valid State accreditation certificate. Documentation will be kept on-site.
4. I verify that I meet the minimum qualifications criteria of the VA specifications for a CPIH.

Signature of CPIH:

Date:

Printed Name of CPIH:

Signature of Contractor:

Date:

Printed Name of Contractor:

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**ATTACHMENT #4**

**ABATEMENT CONTRACTOR/COMPETENT PERSON(S) REVIEW AND ACCEPTANCE OF THE  
VA'S ASBESTOS SPECIFICATIONS**

VA Project Location:

VA Project #:

VA Project Description:

This form shall be signed by the Asbestos Abatement Contractor Owner and the Asbestos Abatement Contractor's Competent Person(s) prior to any start of work at the VA related to this Specification. If the Asbestos Abatement Contractor's/Competent Person(s) has not signed this form, they shall not be allowed to work on-site.

I, the undersigned, have read VA's Asbestos Specification regarding the asbestos abatement requirements. I understand the requirements of the VA's Asbestos Specification and agree to follow these requirements as well as all required rules and regulations of OSHA/EPA/DOT and State/Local requirements. I have been given ample opportunity to read the VA's Asbestos Specification and have been given an opportunity to ask any questions regarding the content and have received a response related to those questions. I do not have any further questions regarding the content, intent and requirements of the VA's Asbestos Specification.

At the conclusion of the asbestos abatement, I will certify that all asbestos abatement work was done in accordance with the VA's Asbestos Specification and all ACM was removed properly and no fibrous residue remains on any abated surfaces.

Abatement Contractor Owner's Signature

Date

Abatement Contractor Competent Person(s)

Date

Date

Date

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SECTION 03 30 53  
CAST-IN-PLACE CONCRETE

**PART 1 - GENERAL**

**1.1 DESCRIPTION:**

This section specifies cast-in-place structural concrete and material and mixes for other concrete.

**1.2 RELATED WORK:**

- A. Materials testing and inspection during construction: Section 01 45 29, TESTING LABORATORY SERVICES.

**1.3 TOLERANCES:**

- A. ACI 117.
- B. Slab Finishes: ACI 117, F-number method in accordance with ASTM E1155.

**1.4 REGULATORY REQUIREMENTS:**

- A. ACI SP-66 ACI Detailing Manual
- B. ACI 318 - Building Code Requirements for Reinforced Concrete.

**1.5 SUBMITTALS:**

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Concrete Mix Design.
- C. Shop Drawings: Reinforcing steel: Complete shop drawings.
- D. Manufacturer's Certificates: Air-entraining admixture, chemical admixtures, curing compounds, bonding agents and polymer patching mortar.

**1.6 APPLICABLE PUBLICATIONS:**

- A. Publications listed below form a part of this specification to extent referenced. Publications are referenced in text by basic designation only.
- B. American Concrete Institute (ACI):
  - 117-10 .....Specification for Tolerances for Concrete Construction, Materials and Commentary
  - 211.1-91(R2009) .....Standard Practice for Proportions for Normal, Heavyweight, and Mass Concrete
  - 211.2-98(R2004) .....Standard Practice for Selecting Proportions for Structural Lightweight Concrete
  - 301-10 .....Specifications for Structural Concrete
  - 305.1-06 .....Specification for Hot Weather Concreting
  - 306.1-90(R2002) .....Standard Specification for Cold Weather Concreting
  - SP-66-04 .....ACI Detailing Manual

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- 318-11 .....Building Code Requirements for Structural  
Concrete and Commentary
- C. American Society for Testing And Materials (ASTM):
- A185/A185M-07 .....Standard Specification for Steel Welded Wire  
Reinforcement, Plain, for Concrete Reinforcement
- A615/A615M-09 .....Standard Specification for Deformed and Plain  
Carbon Steel Bars for Concrete Reinforcement
- C31/C31M-10 .....Standard Practice for Making and Curing Concrete  
Test Specimens in the Field
- C33/C33M-11a .....Standard Specification for Concrete Aggregates
- C39/C39M-12 .....Standard Test Method for Compressive Strength of  
Cylindrical Concrete Specimens
- C94/C94M-12 .....Standard Specification for Ready Mixed Concrete
- C143/C143M-10 .....Standard Test Method for Slump of Hydraulic  
Cement Concrete
- C150-11 .....Standard Specification for Portland Cement
- C171-07 .....Standard Specification for Sheet Material for  
Curing Concrete
- C172-10 .....Standard Practice for Sampling Freshly Mixed  
Concrete
- C173-10 .....Standard Test Method for Air Content of Freshly  
Mixed Concrete by the Volumetric Method
- C192/C192M-07 .....Standard Practice for Making and Curing Concrete  
Test Specimens in the Laboratory
- C231-10 .....Standard Test Method for Air Content of Freshly  
Mixed Concrete by the Pressure Method
- C260-10 .....Standard Specification for Air-Entraining  
Admixtures for Concrete
- C330-09 .....Standard Specification for Lightweight  
Aggregates for Structural Concrete
- C494/C494M-11 .....Standard Specification for Chemical Admixtures  
for Concrete
- C618-12 .....Standard Specification for Coal Fly Ash and Raw  
or Calcined Natural Pozzolan for Use in Concrete
- D1751-04(R2008) .....Standard Specification for Preformed Expansion  
Joint Fillers for Concrete Paving and Structural  
Construction (Non-extruding and Resilient  
Bituminous Types)

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D4397-10 .....Standard Specification for Polyethylene Sheeting  
for Construction, Industrial and Agricultural  
Applications

E1155-96(2008) .....Standard Test Method for Determining  $F_F$  Floor  
Flatness and  $F_L$  Floor Levelness Numbers

**PART 2 - PRODUCTS**

**2.1 MATERIALS:**

- A. Portland Cement: ASTM C150, Type I or II.
- B. Fly Ash: ASTM C618, Class C or F including supplementary optional requirements relating to reactive aggregates and alkalis, and loss on ignition (LOI) not to exceed 5 percent.
- C. Coarse Aggregate: ASTM C33, Size 67. Size 467 may be used for footings and walls over 300 mm (12 inches) thick. Coarse aggregate for applied topping and metal pan stair fill shall be Size 7.
- D. Fine Aggregate: ASTM C33.
- E. Lightweight Aggregate for Structural Concrete: ASTM C330, Table 1
- F. Mixing Water: Fresh, clean, and potable.
- G. Air-Entraining Admixture: ASTM C260.
- H. Chemical Admixtures: ASTM C494.
- I. Reinforcing Steel: ASTM A615 or ASTM A996, deformed. See structural drawings for grade.
- J. Welded Wire Fabric: ASTM A185.
- K. Sheet Materials for Curing Concrete: ASTM C171.
- L. Abrasive Aggregates: Aluminum oxide grains or emery grits.
- M. Polymer Patching Mortar: Free flowing, polymer modified cementitious mortar. Subject to compliance with requirements provide one of the following:
  - 1. Sikatop or Sikatop 123 Plus (vertical and overhead repairs) by Sika Corporation.
  - 2. Thin-Top Supreme or Concrete-Top Supreme (horizontal repairs) or Verticoat/Verticoat Supreme (vertical and overhead repairs) by The Euclid Chemical Co.
- N. Epoxy Resin Bonding Agent: ASTM C 881 two component 100 percent solids mineral filled epoxy-polysulfide polymer. Subject to compliance with requirements provide one of the following:
  - 1. Sikadur 32 Hi-Mod by Sika Corporation.
  - 2. Euco #452 or #620 (MV) by The Euclid Chemical Co.
  - 3. Epobond by L&M Construction Chemicals.
  - 4. Coneresive 1090 by BASF Construction Chemicals.

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**2.3 CONCRETE MIXES:**

- A. Design of concrete mixes using materials specified shall be the responsibility of the Contractor as set forth under Option C of ASTM C94.
- B. Compressive strength at 28 days shall be not less than 3000 psi.
- C. Maximum slump for vibrated concrete is 100 mm (4 inches) tested in accordance with ASTM C143.

**TABLE II TOTAL AIR CONTENT  
AIR CONTENT OF LIGHTWEIGHT STRUCTURAL CONCRETE**

Nominal Maximum Size of Total Air Content	Coarse Aggregate, mm's (Inches) Percentage by Volume
Greater than 10 mm (3/8 in) 4 to 8	10 mm (3/8 in) or less 5 to 9

**2.4 BATCHING & MIXING:**

- A. Store, batch, and mix materials as specified in ASTM C94.
  - 1. Job-Mixed: Concrete mixed at job site shall be mixed in a batch mixer in manner specified for stationary mixers in ASTM C94.
  - 2. Ready-Mixed: Ready-mixed concrete comply with ASTM C94, except use of non-agitating equipment for transporting concrete to the site will not be permitted. With each load of concrete delivered to project, ready-mixed concrete producer shall furnish, in duplicate, certification as required by ASTM C94.
  - 3. Mixing structural lightweight concrete: Charge mixer with 2/3 of total mixing water and all of the aggregate. Mix ingredients for not less than 30 seconds in a stationary mixer or not less than 10 revolutions at mixing speed in a truck mixer. Add remaining mixing water and other ingredients and continue mixing. Above procedure may be modified as recommended by aggregate producer.

**PART 3 - EXECUTION**

**3.1 REINFORCEMENT:**

Details of concrete reinforcement, unless otherwise shown, in accordance with ACI 318 and ACI SP-66. Support and securely tie reinforcing steel to prevent displacement during placing of concrete.

**3.2 PLACING CONCRETE:**

- A. Remove water from excavations before concrete is placed. Remove hardened concrete, debris and other foreign materials from interior of forms, and from inside of mixing and conveying equipment. Obtain approval of

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Resident Engineer before placing concrete. Provide screeds at required elevations for concrete slabs.

- B. Before placing new concrete on or against concrete which has set, existing surfaces shall be roughened and cleaned free from all laitance, foreign matter, loose particles, and apply bonding agent.
- C. Convey concrete from mixer to final place of deposit by method which will prevent segregation or loss of ingredients. Do not deposit in work concrete that has attained its initial set or has contained its water or cement more than 1 1/2 hours. Do not allow concrete to drop freely more than 1500 mm (5 feet) in unexposed work nor more than 900 mm (3 feet) in exposed work. Place and consolidate concrete in horizontal layers not exceeding 300 mm (12 inches) in thickness. Consolidate concrete by spading, rodding, and mechanical vibrator. Do not secure vibrator to forms or reinforcement. Vibration shall be carried on continuously with placing of concrete.
- D. Hot weather placing of concrete: Follow recommendations of ACI 305R to prevent problems in the manufacturing, placing, and curing of concrete that can adversely affect the properties and serviceability of the hardened concrete.
- E. Cold weather placing of concrete: Follow recommendations of ACI 306R, to prevent freezing of thin sections less than 300 mm (12 inches) and to permit concrete to gain strength properly, except that use of calcium chloride shall not be permitted without written approval from Resident Engineer.

**3.3 PROTECTION AND CURING:**

Protect exposed surfaces of concrete from premature drying, wash by rain or running water, wind, mechanical injury, and excessively hot or cold temperature. Curing method shall be subject to approval by Resident Engineer.

**3.4 FINISHES:**

- A. Vertical and Overhead Surface Finishes:
  - 1. Unfinished Areas: Vertical and overhead concrete surfaces exposed in unfinished areas, above suspended ceilings in manholes, and other unfinished areas exposed or concealed will not require additional finishing.
- B. Slab Finishes:
  - 1. Scratch Finish: Slab surfaces to receive a bonded applied cementitious application shall all be thoroughly raked or wire broomed after partial setting (within 2 hours after placing) to

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roughen surface to insure a permanent bond between base slab and applied cementitious materials.

2. Floating: Allow water brought to surface by float used for rough finishing to evaporate before surface is again floated or troweled.

Do not sprinkle dry cement on surface to absorb water.

**3.5 APPLIED TOPPING:**

- A. Separate concrete topping with thickness and strength shown with only enough water to insure a stiff, workable, plastic mix.
- B. Continuously place applied topping until entire section is complete, struck off with straightedge, compact by rolling or tamping, float and steel trowel to a hard smooth finish.

**3.6 RESURFACING FLOORS:**

Remove existing flooring, in areas to receive resurfacing, to expose existing structural slab and to extend not less than 25 mm (1 inch) below new finished floor level. Prepare exposed structural slab surface by roughening, broom cleaning, wetting, and grouting. Apply topping as specified.

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SECTION 03 54 16

HYDRAULIC CEMENT UNDERLAYMENT

**PART 1 - GENERAL**

**1.1 SUMMARY**

- A. Section includes hydraulic-cement-based, polymer-modified, self-leveling underlayment for application below interior floor coverings.
  - 1. Provide hydraulic cement underlayment on all existing floor surfaces within project limits. Allow for additional depths required at removal of existing partitions and walls that extend below surface of existing topping slab.

**1.2 ACTION SUBMITTALS**

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: Include plans indicating substrates, locations, and average depths of underlayment based on survey of substrate conditions.

**1.3 INFORMATIONAL SUBMITTALS**

- A. Product Certificates: Signed by manufacturers of underlayment and floor-covering systems certifying that products are compatible.
- B. Minutes of preinstallation conference.

**1.4 QUALITY ASSURANCE**

- A. Installer Qualifications: Installer who is approved by manufacturer for application of underlayment products required for this Project.
- B. Product Compatibility: Manufacturers of underlayment and floor-covering systems certify in writing that products are compatible.
- C. Preinstallation Conference: Conduct conference at Project site.

**1.5 DELIVERY, STORAGE, AND HANDLING**

- A. Store materials to comply with manufacturer's written instructions to prevent deterioration from moisture or other detrimental effects.

**1.6 PROJECT CONDITIONS**

- A. Environmental Limitations: Comply with manufacturer's written instructions for substrate temperature, ventilation, ambient temperature and humidity, and other conditions affecting underlayment performance.
  - 1. Place hydraulic-cement-based underlayments only when ambient temperature and temperature of substrates are between 50 and 80

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deg F.

**1.7 COORDINATION**

- A. Coordinate application of underlayment with requirements of floor-covering products and adhesives, to ensure compatibility of products.

**PART 2 - PRODUCTS**

**2.1 HYDRAULIC-CEMENT-BASED UNDERLAYMENTS**

- A. Underlayment: Hydraulic-cement-based, polymer-modified, self-leveling product that can be applied in minimum uniform thickness of 1/4 inch and that can be feathered at edges to match adjacent floor elevations.
  - 1. Cement Binder: ASTM C 150, portland cement, or hydraulic or blended hydraulic cement as defined by ASTM C 219.
  - 2. Compressive Strength: Not less than 4000 psi at 28 days when tested according to ASTM C 109/C 109M.
- B. Aggregate: Well-graded, washed gravel, 1/8 to 1/4 inch; or coarse sand as recommended by underlayment manufacturer.
  - 1. Provide aggregate when recommended in writing by underlayment manufacturer for underlayment thickness required.
- C. Water: Potable and at a temperature of not more than 70 deg F.
- D. Primer: Product of underlayment manufacturer recommended in writing for substrate, conditions, and application indicated.
  - 1. Primer shall have a VOC content of 200 g/L or less when calculated according to 40 CFR 59, Subpart D.

**PART 3 - EXECUTION**

**3.1 EXAMINATION**

- A. Examine substrates, with Installer present, for conditions affecting performance.
  - 1. Proceed with application only after unsatisfactory conditions have been corrected.

**3.2 PREPARATION**

- A. General: Prepare and clean substrate according to manufacturer's written instructions.
  - 1. Treat nonmoving substrate cracks according to manufacturer's written instructions to prevent cracks from telegraphing (reflecting) through underlayment.
  - 2. Fill substrate voids to prevent underlayment from leaking.

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- B. Concrete Substrates: Mechanically remove, according to manufacturer's written instructions, laitance, glaze, efflorescence, curing compounds, form-release agents, dust, dirt, grease, oil, and other contaminants that might impair underlayment bond.
  - 1. Moisture Testing: Perform anhydrous calcium chloride test, ASTM F 1869. Proceed with installation only after substrates do not exceed a maximum moisture-vapor-emission rate of 3 lb of water/1000 sq. ft. in 24 hours.
- C. Nonporous Substrates: For terrazzo and other non-porous substrates not indicated to be removed, remove waxes, sealants, and other contaminants that might impair underlayment bond, and mechanically grind and prepare surfaces according to manufacturer's written instructions.
- D. Adhesion Tests: After substrate preparation, test substrate for adhesion with underlayment according to manufacturer's written instructions.

**3.3 APPLICATION**

- A. General: Mix and apply underlayment components according to manufacturer's written instructions.
  - 1. Close areas to traffic during underlayment application and for time period after application recommended in writing by manufacturer.
  - 2. Coordinate application of components to provide optimum underlayment-to-substrate and intercoat adhesion.
  - 3. At substrate expansion, isolation, and other moving joints, allow joint of same width to continue through underlayment.
- B. Apply primer over prepared substrate at manufacturer's recommended spreading rate.
- C. Apply underlayment to produce uniform, level surface.
  - 1. Apply a final layer without aggregate to product surface.
  - 2. Feather edges to match adjacent floor elevations.
- D. Cure underlayment according to manufacturer's written instructions. Prevent contamination during application and curing processes.
- E. Do not install floor coverings over underlayment until after time period recommended in writing by underlayment manufacturer.
- F. Remove and replace underlayment areas that evidence lack of bond with substrate, including areas that emit a "hollow" sound when tapped.

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**3.4 PROTECTION**

- A. Protect underlayment from concentrated and rolling loads for remainder of construction period.

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SECTION 05 40 00

COLD-FORMED METAL FRAMING

PART 1 - GENERAL

1.1 DESCRIPTION:

- A. This section specifies materials and services required for installation of cold-formed steel, including tracks and required accessories as shown and specified. This Section includes the following:

- 1. Interior load-bearing steel stud walls.

1.2 RELATED WORK:

- A. Non-load-bearing metal stud framing assemblies: Section 09 22 16, NON-STRUCTURAL METAL FRAMING.
- B. Gypsum board assemblies: Section 09 29 00, GYPSUM BOARD.

1.3 DESIGN REQUIREMENTS:

- A. Design steel in accordance with American Iron and Steel Institute Publication "Specification for the Design of Cold-Formed Steel Structural Members", except as otherwise shown or specified.
- B. Structural Performance: Engineer, fabricate, and erect cold-formed metal framing to withstand design loads within limits and under conditions required.
  - 1. Design Loads: As indicated.
  - 2. Design framing systems to withstand design loads without deflections greater than the following:
    - a. Interior Load-Bearing Walls: Lateral deflection of 1/240 of the wall height.
  - 3. Design framing systems to provide for movement of framing members without damage or overstressing, sheathing failure, connection failure, undue strain on fasteners and anchors, or other detrimental effects when subject to a maximum ambient temperature change (range) of 67 degrees C (120 degrees F).
  - 4. Design framing system to accommodate deflection of primary building structure and construction tolerances, and to maintain clearances at openings.
  - 5. Engineering Responsibility: Engage a fabricator who assumes undivided responsibility for engineering cold-formed metal framing by employing a qualified professional engineer to prepare design calculations, shop drawings, and other structural data.

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**1.4 SUBMITTALS:**

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Shop Drawings: Shop and erection drawings showing steel unit layout, connections to supporting members, and information necessary to complete installation as shown and specified.
- C. Manufacturer's Literature and Data: Showing steel component sections and specifying structural characteristics.
- D. For cold-formed metal framing indicated to comply with certain design loadings, include structural analysis data sealed and signed by the qualified professional engineer who was responsible for its preparation.

**1.5 APPLICABLE PUBLICATIONS:**

- A. Publications listed below form a part of this specification to extent referenced. Publications are referenced in text by basic designation only.
- B. American Iron and Steel Institute (AISI):
- C. Specification and Commentary for the Design of Cold-Formed Steel Structural Members (1996)
- D. American Society of Testing and Materials (ASTM):
  - 1. A36/A36M-08 Standard Specifications for Carbon Structural Steel
  - 2. A123/A123M-09 Standard Specifications for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
  - 3. A153/A153M-09 Standard Specifications for Zinc Coating (Hot-Dip) on Iron and Steel Hardware
  - 4. A307-10 Standard Specifications for Carbon Steel Bolts and Studs
  - 5. A653/A653M-10 Standard Specifications for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
  - 6. C1107/C1107M-08 Standard Specifications for Packaged Dry, Hydraulic-Cement Grout (Non-shrink)
  - 7. E488-96(R2003) Standard Test Methods for Strength of Anchors in Concrete and Masonry Elements
  - 8. E1190-95(R2007) Standard Test Methods for Strength of Power-Actuated Fasteners Installed in Structural Members

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E. American Welding Society (AWS):

1. D1.3/D1.3M-08 Structural Welding Code-Sheet Steel

F. Military Specifications (Mil. Spec.):

1. MIL-P-21035B Paint, High Zinc Dust Content, Galvanizing Repair

**PART 2 - PRODUCTS**

**2.1 MATERIALS:**

- A. Sheet Steel for joists, studs and accessories 16 gage and heavier:  
ASTM A653, structural steel, zinc coated G90, with a yield of 340 MPa  
(50 ksi) minimum.
- B. Sheet Steel for joists, studs and accessories 18 gage and lighter:  
ASTM A653, structural steel, zinc coated G90, with a yield of 230 MPa  
(33 ksi) minimum.
- C. Galvanizing Repair Paint: MIL-P-21035B.

**2.2 WALL FRAMING:**

- A. Steel Studs: Manufacturer's standard C-shaped steel studs of web depth indicated, with lipped flanges, and complying with the following:
  1. Design Uncoated-Steel Thickness:
    - a. 0.91 mm (0.0358 inch)
    - b. 1.20 mm (0.0474 inch)
    - c. 1.52 mm (0.0598 inch)
    - d. (0.0747 inch)
    - e. 2.66 mm (0.1046 inch)
  2. Flange Width:
    - a. 35 mm (1-3/8 inches)
    - b. (1-5/8 inches)
    - c. (2 inches)
    - d. (2-1/2 inches)
  3. Web: Unpunched.
- B. Steel Track: Manufacturer's standard U-shaped steel track, unpunched, of web depths indicated, with straight flanges, and complying with the following:
  1. Design Uncoated-Steel Thickness: Matching steel studs.
  2. Flange Width: Manufacturer's standard deep flange where indicated, standard flange elsewhere.

**2.3 FRAMING ACCESSORIES:**

- A. Fabricate steel framing accessories of the same material and finish used for framing members, with a minimum yield strength of 230 MPa

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(33 ksi).

B. Provide accessories of manufacturer's standard thickness and configuration, unless otherwise indicated, as follows:

1. Supplementary framing.
2. Bracing, bridging, and solid blocking.
3. Web stiffeners.
4. Gusset plates.
5. Deflection track and vertical slide clips.
6. Stud kickers and girts.
7. Reinforcement plates.

**2.4 ANCHORS, CLIPS, AND FASTENERS:**

- A. Steel Shapes and Clips: ASTM A36, zinc coated by the hot-dip process according to ASTM A123.
- B. Expansion Anchors: Fabricated from corrosion-resistant materials, with capability to sustain, without failure, a load equal to 5 times the design load, as determined by testing per ASTM E488 conducted by a qualified independent testing agency.
- C. Mechanical Fasteners: Corrosion-resistant coated, self-drilling, self-threading steel drill screws. Low-profile head beneath sheathing, manufacturer's standard elsewhere.

**2.5 REQUIREMENTS:**

- A. Welding in accordance with AWS D1.3
- B. Furnish members and accessories by one manufacturer only.

**PART 3 - EXECUTION**

**3.1 FABRICATION:**

- A. Framing components may be preassembled into panels. Panels shall be square with components attached.
- B. Cut framing components squarely or as required for attachment. Cut framing members by sawing or shearing; do not torch cut.
- C. Hold members in place until fastened.
- D. Fasten cold-formed metal framing members by welding or screw fastening, as standard with fabricator. Wire tying of framing members is not permitted.
  1. Comply with AWS requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.



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2. Locate mechanical fasteners and install according to cold-formed metal framing manufacturer's instructions with screw penetrating joined members by not less than 3 exposed screw threads.

E. Where required, provide specified insulation in double header members and double jamb studs which will not be accessible after erection.

**3.2 ERECTION:**

A. Handle and lift prefabricated panels in a manner as to not distort any member.

B. Securely anchor tracks to supports as shown.

C. At butt joints, securely anchor two pieces of track to same supporting member or butt-weld or splice together.

D. Plumb, align, and securely attach studs to flanges or webs of both upper and lower tracks.

E. All axially loaded members shall be aligned vertically to allow for full transfer of the loads down to the foundation. Vertical alignment shall be maintained at floor/wall intersections.

F. Install jack studs above and below openings and as required to furnish support. Securely attach jack studs to supporting members.

G. Install headers in all openings that are larger than the stud spacing in that wall.

H. Attach bridging for studs in a manner to prevent stud rotation. Space bridging rows as shown.

I. Studs in one piece for their entire length, splices will not be permitted.

J. Provide temporary bracing and leave in place until framing is permanently stabilized.

K. Do not bridge building expansion joints with cold-formed metal framing. Independently frame both sides of joints.

L. Fasten reinforcement plate over web penetrations that exceed size of manufacturer's standard punched openings.

**3.3 TOLERANCES:**

A. Vertical alignment (plumbness) of studs shall be within 1/960th of the span.

B. Horizontal alignment (levelness) of walls shall be within 1/960th of their respective lengths.

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- C. Spacing of studs shall not be more than 3 mm (1/8 inch) +/- from the designed spacing providing that the cumulative error does not exceed the requirements of the finishing materials.
- D. Prefabricated panels shall be not more than 3 mm (1/8 inch) +/- out of square within the length of that panel.

**3.4 FIELD REPAIR:**

- A. Touch-up damaged galvanizing with galvanizing repair paint.

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**SECTION 05 50 00**

**METAL FABRICATIONS**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

- A. This section specifies items and assemblies fabricated from structural steel shapes, stainless steel, and other materials as shown and specified.
- B. Items specified.
  - 1. Support for Wall and Ceiling Mounted Items: (12, 14A, 14C)
  - 2. Steel Counter or Bench Top Frame and Leg
  - 3. Stainless steel column enclosures
  - 4. Stainless steel metal base
  - 5. Stainless steel trim at Reception Desk
  - 6. Steel fin tube cover with aluminum grille as shown on Drawings.
  - 7. Aluminum extrusion at terminations of tile as shown on Drawings.

**1.2 RELATED WORK**

- A. Colors, finishes, and textures: Finish Schedule.
- B. Prime and finish painting: Section 09 91 00, PAINTING.

**1.3 SUBMITTALS**

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Shop Drawings:
  - 1. Each item specified, showing complete detail, location in the project, material and size of components, method of joining various components and assemblies, finish, and location, size and type of anchors.
  - 2. Mark items requiring field assembly for erection identification and furnish erection drawings and instructions.
  - 3. Provide templates and rough-in measurements as required.

**1.4 QUALITY ASSURANCE**

- A. Each manufactured product shall meet, as a minimum, the requirements specified, and shall be a standard commercial product of a manufacturer regularly presently manufacturing items of type specified.
- B. Each product type shall be the same and be made by the same manufacturer.

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- C. Assemble product to the greatest extent possible before delivery to the site.
- D. Include additional features, which are not specifically prohibited by this specification, but which are a part of the manufacturer's standard commercial product.

**1.5 APPLICABLE PUBLICATIONS**

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.
- B. American Society of Mechanical Engineers (ASME):
  - 1. B18.6.1-81(R1997) Wood Screws
  - 2. B18.2.2-87(R2005) Square and Hex Nuts
- C. American Society for Testing and Materials (ASTM):
  - 1. A36/A36M-05 Structural Steel
  - 2. A47-99(R2004) Malleable Iron Castings
  - 3. A48-03 Gray Iron Castings
  - 4. A53-06 Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless
  - 5. A123-02 Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
  - 6. A307-07 Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength
  - 7. A653/A653M-07 Steel Sheet, Zinc Coated (Galvanized) or Zinc-Iron Alloy Coated (Galvannealed) by the Hot-Dip Process
  - 8. F436-07 Hardened Steel Washers
  - 9. F468-06 Nonferrous Bolts, Hex Cap Screws, and Studs for General Use
  - 10. F593-02 Stainless Steel Bolts, Hex Cap Screws, and Studs
  - 11. F1667-05 Driven Fasteners: Nails, Spikes and Staples
- D. American Welding Society (AWS):
  - 1. D1.1-04 Structural Welding Code Steel
  - 2. D1.3-98 Structural Welding Code Sheet Steel
- E. Structural Steel Painting Council (SSPC):
  - 1. SP 1-05 No. 1, Solvent Cleaning
  - 2. SP 2-05 No. 2, Hand Tool Cleaning
  - 3. SP 3-05 No. 3, Power Tool Cleaning

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**PART 2 - PRODUCTS**

**2.1 MATERIALS**

- A. Structural Steel: ASTM A36.
- B. Stainless Steel: ASTM A167, Type 302 or 304.
- C. Aluminum, Extruded: ASTM B221, Alloy 6063-T5 unless otherwise specified. For structural shapes use alloy 6061-T6 and alloy 6061-T4511.
- D. Steel Pipe: ASTM A53.
  - 1. Galvanized for exterior locations.
  - 2. Type S, Grade A unless specified otherwise.
  - 3. NPS (inside diameter) as shown.
- E. Primer Paint: As specified in Section 09 91 00, PAINTING.

**2.2 HARDWARE**

- A. Rough Hardware:
  - 1. Furnish rough hardware with a standard plating, applied after punching, forming and assembly of parts; galvanized, cadmium plated, or zinc-coated by electro-galvanizing process. Galvanized G-90 where specified.
- B. Fasteners:
  - 1. Bolts with Nuts:
    - a. ASME B18.2.2.
    - b. ASTM A307 for 415 MPa (60,000 psi) tensile strength bolts.
    - c. ASTM F468 for nonferrous bolts.
  - 2. Screws: ASME B18.6.1.
  - 3. Washers: ASTM F436, type to suit material and anchorage.
  - 4. Nails: ASTM F1667, Type I, style 6 or 14 for finish work.

**2.3 FABRICATION GENERAL**

- A. Material
  - 1. Use material as specified. Use material of commercial quality and suitable for intended purpose for material that is not named or its standard of quality not specified.
  - 2. Use material free of defects which could affect the appearance or service ability of the finished product.
- B. Size:
  - 1. Size and thickness of members as shown.
  - 2. When size and thickness is not specified or shown for an individual part, use size and thickness not less than that used for the same

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component on similar standard commercial items or in accordance with established shop methods.

**C. Connections**

1. Except as otherwise specified, connections may be made by welding, riveting or bolting.
2. Field riveting will not be approved.
3. Design size, number and placement of fasteners, to develop a joint strength of not less than the design value.
4. Holes, for rivets and bolts: Accurately punched or drilled and burrs removed.
5. Size and shape welds to develop the full design strength of the parts connected by welds and to transmit imposed stresses without permanent deformation or failure when subject to service loadings.
6. Use Rivets and bolts of material selected to prevent corrosion (electrolysis) at bimetallic contacts. Plated or coated material will not be approved.

**D. Fasteners and Anchors**

1. Use methods for fastening or anchoring metal fabrications to building construction as shown or specified.
2. Where fasteners and anchors are not shown, design the type, size, location and spacing to resist the loads imposed without deformation of the members or causing failure of the anchor or fastener, and suit the sequence of installation.
3. Use material and finish of the fasteners compatible with the kinds of materials which are fastened together and their location in the finished work.
4. Fasteners for securing metal fabrications to new construction only, may be by use of threaded or wedge type inserts or by anchors for welding to the metal fabrication for installation before the concrete is placed or as masonry is laid.
5. Fasteners for securing metal fabrication to existing construction or new construction may be expansion bolts, toggle bolts, power actuated drive pins, welding, self drilling and tapping screws or bolts.

**E. Workmanship**

1. General:
  - a. Fabricate items to design shown.

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- b. Furnish members in longest lengths commercially available within the limits shown and specified.
  - c. Fabricate straight, true, free from warp and twist, and where applicable square and in same plane.
  - d. Provide holes, sinkages and reinforcement shown and required for fasteners and anchorage items.
  - e. Provide openings, cut-outs, and tapped holes for attachment and clearances required for work of other trades.
  - f. Prepare members for the installation and fitting of hardware.
  - g. Cut openings in gratings and floor plates for the passage of ducts, sumps, pipes, conduits and similar items. Provide reinforcement to support cut edges.
  - h. Fabricate surfaces and edges free from sharp edges, burrs and projections which may cause injury.
2. Welding:
- a. Weld in accordance with AWS.
  - b. Welds shall show good fusion, be free from cracks and porosity and accomplish secure and rigid joints in proper alignment.
  - c. Where exposed in the finished work, continuous weld for the full length of the members joined and have depressed areas filled and protruding welds finished smooth and flush with adjacent surfaces.
  - d. Finish welded joints to match finish of adjacent surface.
3. Joining:
- a. Miter or butt members at corners.
  - b. Where frames members are butted at corners, cut leg of frame member perpendicular to surface, as required for clearance.
4. Anchors:
- a. Where metal fabrications are shown to be preset in concrete, weld 32 x 3 mm (1-1/4 by 1/8 inch) steel strap anchors, 150 mm (6 inches) long with 25 mm (1 inch) hooked end, to back of member at 600 mm (2 feet) on center, unless otherwise shown.
  - b. Where metal fabrications are shown to be built into masonry use 32 x 3 mm (1-1/4 by 1/8 inch) steel strap anchors, 250 mm (10 inches) long with 50 mm (2 inch) hooked end, welded to back of member at 600 mm (2 feet) on center, unless otherwise shown.

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5. Cutting and Fitting:

- a. Accurately cut, machine and fit joints, corners, copes, and miters.
- b. Fit removable members to be easily removed.
- c. Design and construct field connections in the most practical place for appearance and ease of installation.
- d. Fit pieces together as required.
- e. Fabricate connections for ease of assembly and disassembly without use of special tools.
- f. Joints firm when assembled.
- g. Conceal joining, fitting and welding on exposed work as far as practical.
- h. Do not show rivets and screws prominently on the exposed face.
- i. The fit of components and the alignment of holes shall eliminate the need to modify component or to use exceptional force in the assembly of item and eliminate the need to use other than common tools.

F. Finish:

1. Finish exposed surfaces in accordance with NAAMM Metal Finishes Manual.
2. Aluminum: NAAMM AMP 501.
  - a. Clear anodic coating, AA-C22A41, chemically etched medium matte, with Architectural Class 1, 0.7 mils or thicker.
  - b. Colored anodic coating, AA-C22A42, chemically etched medium matte with Architectural Class 1, 0.7 mils or thicker.
  - c. Painted: AA-C22R10.
3. Steel and Iron: NAAMM AMP 504.
  - a. Zinc coated (Galvanized): ASTM A123, G90 unless noted otherwise.
  - b. Surfaces exposed in the finished work:
    - 1) Finish smooth rough surfaces and remove projections.
    - 2) Fill holes, dents and similar voids and depressions with epoxy type patching compound.
  - c. Shop Prime Painting:
    - 1) Surfaces of Ferrous metal:
      - a) Items not specified to have other coatings.
      - b) Galvanized surfaces specified to have prime paint.



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- c) Remove all loose mill scale, rust, and paint, by hand or power tool cleaning as defined in SSPC-SP2 and SP3.
- d) Clean of oil, grease, soil and other detrimental matter by use of solvents or cleaning compounds as defined in SSPC-SP1.
- e) After cleaning and finishing apply one coat of primer as specified in Section 09 91 00, PAINTING.

2) Non ferrous metals: Comply with MAAMM-500 series.

4. Stainless Steel: NAAMM AMP-504 Finish No. 4.

**G. Protection:**

- 1. Insulate aluminum surfaces that will come in contact with concrete, masonry, plaster, or metals other than stainless steel, zinc or white bronze by giving a coat of heavy-bodied alkali resisting bituminous paint or other approved paint in shop.
- 2. Spot prime all abraded and damaged areas of zinc coating which expose the bare metal, using zinc rich paint on hot-dip zinc coat items and zinc dust primer on all other zinc coated items.

**2.4 SUPPORTS**

**A. General:**

- 1. Fabricate ASTM A36 structural steel shapes as shown.
- 2. Use clip angles or make provisions for welding hangers and braces to overhead construction.
- 3. Field connections may be welded or bolted.

**B. For Ceiling Hung Toilet Stall:**

- 1. Use a continuous steel channel above pilasters with hangers centered over pilasters.
- 2. Make provision for installation of stud bolts in lower flange of channel.
- 3. Provide a continuous steel angle at wall and channel braces spaced as shown.
- 4. Use threaded rod hangers.
- 5. Provide diagonal angle brace where the suspended ceiling over toilet stalls does not extend to side wall of room.
- 6. Provide supports for ceiling hung pilasters at dressing booths and entrance screen to toilet room similar to support for toilet stall pilasters.

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**C. For Wall Mounted Items:**

1. For items supported by metal stud partitions.
2. Steel strip or hat channel minimum of 1.5 mm (0.0598 inch) thick.
3. Steel strip minimum of 150 mm (6 inches) wide, length extending one stud space beyond end of item supported.
4. Steel hat channels where shown. Flange cut and flattened for anchorage to stud.
5. Structural steel tube or channel for grab bar at water closets floor to structure above with clip angles or end plates formed for anchors.
6. Use steel angles for thru wall counters. Drill angle for fasteners at ends and not over 100 mm (4 inches) on center between ends.

**D. Supports for Various Conditions at Suspended Ceilings:**

1. Fabricate of structural steel shapes as shown.
2. Drill for anchor bolts of suspended item.

**2.5 STEEL COUNTER OR BENCH TOP FRAME AND LEGS**

- A. Fabricate channel or angle frame with mitered and welded corners as shown.
- B. Drill top of frame with 6 mm (1/4 inch) holes spaced 200 mm (8 inches) on center for securing countertop.
- C. Fabricate legs of angle or pipe shapes and continuously weld to frame.
- D. Finish frame with backed on enamel prime coat.

**PART 3 - EXECUTION**

**3.1 INSTALLATION, GENERAL**

- A. Set work accurately, in alignment and where shown, plumb, level, free of rack and twist, and set parallel or perpendicular as required to line and plane of surface.
- B. Items set into concrete or masonry.
  1. Provide temporary bracing for such items until concrete or masonry is set.
  2. Place in accordance with setting drawings and instructions.
  3. Build strap anchors, into masonry as work progresses.
- C. Set frames of gratings, covers, corner guards, trap doors and similar items flush with finish floor or wall surface and, where applicable, flush with side of opening.
- D. Field weld in accordance with AWS.
  1. Design and finish as specified for shop welding.

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2. Use continuous weld unless specified otherwise.
- E. Install anchoring devices and fasteners as shown and as necessary for securing metal fabrications to building construction as specified. Power actuated drive pins may be used except for removable items and where members would be deformed or substrate damaged by their use.
- F. Spot prime all abraded and damaged areas of zinc coating as specified and all abraded and damaged areas of shop prime coat with same kind of paint used for shop priming.
- G. Isolate aluminum from dissimilar metals and from contact with concrete and masonry materials as required to prevent electrolysis and corrosion.
- H. Secure escutcheon plate with set screw.

**3.2 INSTALLATION OF SUPPORTS**

- A. Anchorage to structure.
  1. Secure angles or channels and clips to overhead structural steel by continuous welding unless bolting is shown.
  2. Secure supports to concrete inserts by bolting or continuous welding as shown.
  3. Secure supports to mid height of concrete beams when inserts do not exist with expansion bolts and to slabs, with expansion bolts. unless shown otherwise.
  4. Secure steel plate or hat channels to studs as detailed.
- B. Ceiling Hung Toilet Stalls:
  1. Securely anchor hangers of continuous steel channel above pilasters to structure above.
  2. Bolt continuous steel angle at wall to masonry or weld to face of each metal stud.
  3. Secure brace for steel channels over toilet stall pilasters to wall angle supports with bolts at each end spaced as shown.
  4. Install diagonal angle brace where the suspended ceiling over toilet stalls does not extend to side wall of room.
  5. Install stud bolts in lower flange of channel before installing furred down ceiling over toilet stalls.
  6. Install support for ceiling hung pilasters at entrance screen to toilet room similar to toilet stall pilasters.
- C. Supports for Wall Mounted items:
  1. Locate center of support at anchorage point of supported item.

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2. Locate support at top and bottom of wall hung cabinets.
3. Locate support at top of floor cabinets and shelving installed against walls.
4. Locate supports where required for items shown.

**3.3 STEEL COMPONENTS FOR MILLWORK ITEMS**

- A. Coordinate and deliver to Millwork fabricator for assembly where millwork items are secured to metal fabrications.

**3.4 CLEAN AND ADJUSTING**

- A. Adjust movable parts including hardware to operate as designed without binding or deformation of the members centered in the opening or frame and, where applicable, contact surfaces fit tight and even without forcing or warping the components.
- B. Clean after installation exposed prefinished and plated items and items fabricated from stainless steel, aluminum and copper alloys, as recommended by the metal manufacture and protected from damage until completion of the project.

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**SECTION 06 10 00**

**ROUGH CARPENTRY**

**PART 1 - GENERAL**

**1.1 DESCRIPTION:**

- A. Section specifies wood blocking, furring, nailers, rough hardware, and light wood construction.

**1.2 RELATED WORK:**

- A. Milled woodwork: Section 06 20 00, FINISH CARPENTRY.
- B. Gypsum sheathing: Section 09 29 00, GYPSUM BOARD.

**1.3 SUBMITTALS:**

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Shop Drawings showing framing connection details, fasteners, connections and dimensions.

**1.4 PRODUCT DELIVERY, STORAGE AND HANDLING:**

- A. Protect lumber and other products from dampness both during and after delivery at site.
- B. Pile lumber in stacks in such manner as to provide air circulation around surfaces of each piece.
- C. Stack plywood and other board products so as to prevent warping.
- D. Locate stacks on well drained areas, supported at least 150 mm (6 inches) above grade and cover with well ventilated sheds having firmly constructed over hanging roof with sufficient end wall to protect lumber from driving rain.

**1.5 APPLICABLE PUBLICATIONS:**

- A. Publications listed below form a part of this specification to extent referenced. Publications are referenced in the text by basic designation only.
- B. American Forest and Paper Association (AFPA):
  - 1. National Design Specification for Wood Construction
  - 2. NDS-05 Conventional Wood Frame Construction
- C. American Society of Mechanical Engineers (ASME):
  - 1. B18.2.1-96(R2005) Square and Hex Bolts and Screws
  - 2. B18.2.2-87 Square and Hex Nuts
  - 3. B18.6.1-97 Wood Screws
  - 4. B18.6.4-98(R2005) Thread Forming and Thread Cutting Tapping Screws and Metallic Drive Screws

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- D. American Plywood Association (APA):
  - 1. E30-07 Engineered Wood Construction Guide
- E. American Society for Testing And Materials (ASTM):
  - 1. A47-99(R2009) Ferritic Malleable Iron Castings
  - 2. A48-03(R2008) Gray Iron Castings
  - 3. A653/A653M-10 Steel Sheet Zinc-Coated (Galvanized) or Zinc-Iron Alloy Coated (Galvannealed) by the Hot Dip Process
  - 4. C954-10 Steel Drill Screws for the Application of Gypsum Board or Metal Plaster Bases to Steel Studs from 0.033 inch (2.24 mm) to 0.112-inch (2.84 mm) in thickness
  - 5. C1002-07 Steel Self-Piercing Tapping Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Metal Studs
  - 6. F844-07 Washers, Steel, Plan (Flat) Unhardened for General Use
  - 7. F1667-08 Nails, Spikes, and Staples
- F. Federal Specifications (Fed. Spec.):
  - 1. MM-L-736C Lumber; Hardwood
- G. Commercial Item Description (CID):
  - 1. A-A-55615 Shield, Expansion (Wood Screw and Lag Bolt Self Threading Anchors)
- H. Military Specification (Mil. Spec.):
  - 1. MIL-L-19140E Lumber and Plywood, Fire-Retardant Treated
- I. U.S. Department of Commerce Product Standard (PS)
  - 1. PS 1-95 Construction and Industrial Plywood
  - 2. PS 20-05 American Softwood Lumber Standard

**PART 2 - PRODUCTS**

**2.1 LUMBER:**

- A. Unless otherwise specified, each piece of lumber bear grade mark, stamp, or other identifying marks indicating grades of material, and rules or standards under which produced.
  - 1. Identifying marks in accordance with rule or standard under which material is produced, including requirements for qualifications and authority of the inspection organization, usage of authorized identification, and information included in the identification.
  - 2. Inspection agency for lumber approved by the Board of Review, American Lumber Standards Committee, to grade species used.

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**B. Lumber Other Than Structural:**

1. Unless otherwise specified, species graded under the grading rules of an inspection agency approved by Board of Review, American Lumber Standards Committee.
2. Furring, blocking, nailers and similar items 100 mm (4 inches) and narrower Standard Grade; and, members 150 mm (6 inches) and wider, Number 2 Grade.

**C. Sizes:**

1. Conforming to Prod. Std., PS20.
2. Size references are nominal sizes, unless otherwise specified, actual sizes within manufacturing tolerances allowed by standard under which produced.

**D. Moisture Content:**

1. At time of delivery and maintained at the site.
2. Boards and lumber 50 mm (2 inches) and less in thickness: 19 percent or less.
3. Lumber over 50 mm (2 inches) thick: 25 percent or less.

**E. Fire Retardant Treatment:**

1. Mil Spec. MIL-L-19140 with piece of treated material bearing identification of testing agency and showing performance rating.
2. Treatment and performance inspection, by an independent and qualified testing agency that establishes performance ratings.

**2.2 PLYWOOD**

**A. Comply with Prod. Std., PS 1.**

- B.** Bear the mark of a recognized association or independent inspection agency that maintains continuing control over quality of plywood which identifies compliance by veneer grade, group number, span rating where applicable, and glue type.

**2.3 ROUGH HARDWARE AND ADHESIVES:**

**A. Anchor Bolts:**

1. ASME B18.2.1 and ANSI B18.2.2 galvanized, 13 mm (1/2 inch) unless shown otherwise.
2. Extend at least 200 mm (8 inches) into masonry or concrete with ends bent 50 mm (2 inches).

- B. Miscellaneous Bolts:** Expansion Bolts: C1D, A-A-55615; lag bolt, long enough to extend at least 65 mm (2-1/2 inches) into masonry or concrete. Use 13 mm (1/2 inch) bolt unless shown otherwise.

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C. Washers

1. ASTM F844.
2. Use zinc or cadmium coated steel or cast iron for washers exposed to weather.

D. Screws:

1. Wood to Wood: ANSI B18.6.1 or ASTM C1002.
2. Wood to Steel: ASTM C954, or ASTM C1002.

E. Nails:

1. Size and type best suited for purpose unless noted otherwise. Use aluminum-alloy nails, plated nails, or zinc-coated nails, for nailing wood work exposed to weather and on roof blocking.
2. ASTM F1667:
  - a. Common: Type I, Style 10.
  - b. Concrete: Type I, Style 11.
  - c. Barbed: Type I, Style 26.
  - d. Underlayment: Type I, Style 25.
  - e. Masonry: Type I, Style 27.
  - f. Use special nails designed for use with ties, strap anchors, framing connectors, joists hangers, and similar items. Nails not less than 32 mm (1-1/4 inches) long, 8d and deformed or annular ring shank.

**PART 3 - EXECUTION**

**3.1 INSTALLATION OF FRAMING AND MISCELLANEOUS WOOD MEMBERS:**

A. Conform to applicable requirements of the following:

1. AFPA WCD-number 1, Manual for House Framing for nailing and framing unless specified otherwise.
2. APA for installation of plywood or structural use panels.

B. Fasteners:

1. Nails.
  - a. Nail in accordance with the Recommended Nailing Schedule as specified in AFPA Manual for House Framing where detailed nailing requirements are not specified in nailing schedule. Select nail size and nail spacing sufficient to develop adequate strength for the connection without splitting the members.
  - b. Use special nails with framing connectors.



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- c. Use eight penny or larger nails for nailing through 25 mm (1 inch) thick lumber and for toe nailing 50 mm (2 inch) thick lumber.
- d. Use 16 penny or larger nails for nailing through 50 mm (2 inch) thick lumber.

2. Bolts:

- a. Fit bolt heads and nuts bearing on wood with washers.
- b. Countersink bolt heads flush with the surface of nailers.
- c. Embed in concrete and solid masonry or use expansion bolts. Special bolts or screws designed for anchor to solid masonry or concrete in drilled holes may be used.
- d. Use toggle bolts to hollow masonry or sheet metal.
- e. Use bolts to steel over 2.84 mm (0.112 inch, 11 gage) in thickness. Secure wood nailers to vertical structural steel members with bolts, placed one at ends of nailer and 600 mm (24 inch) intervals between end bolts. Use clips to beam flanges.

3. Drill Screws to steel less than 2.84 mm (0.112 inch) thick.

- a. ASTM C1002 for steel less than 0.84 mm (0.033 inch) thick.
- b. ASTM C 954 for steel over 0.84 mm (0.033 inch) thick.

4. Do not anchor to wood plugs or nailing blocks in masonry or concrete. Use metal plugs, inserts or similar fastening.

5. Screws to Join Wood:

- a. Where shown or option to nails.
- b. ASTM C1002, sized to provide not less than 25 mm (1 inch) penetration into anchorage member.
- c. Spaced same as nails.

C. Blocking Nailers, and Furring:

- 1. Install furring, blocking, nailers, and grounds where shown.
- 2. Use longest lengths practicable.
- 3. Use fire retardant treated wood blocking where shown at openings and where shown or specified.
- 4. Layers of Blocking or Plates:
  - a. Stagger end joints between upper and lower pieces.
  - b. Nail at ends and not over 600 mm (24 inches) between ends.
  - c. Stagger nails from side to side of wood member over 125 mm (5 inches) in width.
- 5. Unless otherwise shown, use wall furring 25 mm by 75 mm (1 inch

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by 3 inch) continuous wood strips installed plumb on walls, using wood shims where necessary so face of furring forms a true, even plane. Space furring not over 400 mm (16 inches on centers, butt joints over bearings and rigidly secure in place. Anchor furring on 400 mm (16 inches) centers.

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**SECTION 06 20 00**

**FINISH CARPENTRY**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

- A. This section specifies interior millwork.
- B. Items specified.
  - 1. Counter Shelf
  - 2. Mounting Strips, Shelves, and Rods
  - 3. Acrylic Panels.
  - 4. Solid Surfacing Horizontal Millwork, Reception Desk, and Window Sills.

**1.2 RELATED WORK**

- A. Fabricated Metal brackets, bench supports and countertop legs: Section 05 50 00, METAL FABRICATIONS.
- B. Framing, furring and blocking: Section 06 10 00, ROUGH CARPENTRY.
- C. Wood doors: Section 08 14 00, INTERIOR WOOD DOORS.
- D. Color and texture of finish: Finish Schedule.
- E. Countertops: 12 36 00, COUNTERTOPS.
- F. Electrical light fixtures and duplex outlets: Division 26, ELECTRICAL.

**1.3 SUBMITTALS**

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Shop Drawings:
  - 1. Millwork items: Half full size scale for sections and details 1:50 (1/4-inch) for elevations and plans.
  - 2. Show construction and installation.
- C. Samples:
  - 1. Plastic laminate finished plywood or particleboard, 150 mm by 300 mm (six inches by twelve inches).
- D. Certificates:
  - 1. Indicating fire retardant treatment of materials meet the requirements specified.
- E. List of acceptable sealers for fire retardant materials.
- F. Manufacturer's literature and data:
  - 1. Finish hardware
  - 2. Electrical components

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**1.4 DELIVERY, STORAGE AND HANDLING**

- A. Protect lumber and millwork from dampness, maintaining moisture content specified both during and after delivery at site.
- B. Store finishing lumber and millwork in weathertight well ventilated structures or in space in existing buildings designated by Resident Engineer. Store at a minimum temperature of 21 deg C (70 deg F) for not less than 10 days before installation.
- C. Pile lumber in stacks in such manner as to provide air circulation around surfaces of each piece.

**1.5 APPLICABLE PUBLICATIONS**

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.
- B. American Society of Testing and Materials (ASTM):
  - 1. A36/A36M-08                      Structural Steel
  - 2. A53-07                              Pipe, Steel, Black and Hot-Dipped Zinc Coated, Welded and Seamless
  - 3. A167-99 (R2009)                  Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip
  - 4. B26/B26M-09                      Aluminum-Alloy Sand Castings
  - 5. B221-08                              Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes
  - 6. E84-09                              Surface Burning Characteristics of Building Materials
- C. American Hardboard Association (AHA):
  - 1. A135.4-04                          Basic Hardboard
- D. Builders Hardware Manufacturers Association (BHMA):
  - 1. A156.9-03                          Cabinet Hardware
  - 2. A156.11-04                        Cabinet Locks
  - 3. A156.16-02                        Auxiliary Hardware
- E. Hardwood Plywood and Veneer Association (HPVA):
  - 1. HP1-09                              Hardwood and Decorative Plywood
- F. National Particleboard Association (NPA):
  - 1. A208.1-99                          Wood Particleboard
- G. Architectural Woodwork Institute (AWI):
  - 1. AWI-99                              Architectural Woodwork Quality Standards and Quality Certification Program
- H. National Electrical Manufacturers Association (NEMA):
  - 1. LD 3-05                              High-Pressure Decorative Laminates
- I. U.S. Department of Commerce, Product Standard (PS):
  - 1. PS20-05                              American Softwood Lumber Standard

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J. Military Specification (Mil. Spec.):

1. MIL-L-19140E Lumber and Plywood, Fire-Retardant Treated

K. Federal Specifications (Fed. Spec.):

1. A-A-1922A Shield Expansion
2. A-A-1936 Contact Adhesive
3. FF-N-836D Nut, Square, Hexagon Cap, Slotted, Castle
4. FF-S-111D(1) Screw, Wood
5. MM-L-736(C) Lumber, Hardwood

**PART 2 - PRODUCTS**

**2.1 LUMBER**

A. Grading and Marking:

1. Lumber shall bear the grade mark, stamp, or other identifying marks indicating grades of material.
2. Such identifying marks on a material shall be in accordance with the rule or standard under which the material is produced, including requirements for qualifications and authority of the inspection organization, usage of authorized identification, and information included in the identification.
3. The inspection agency for lumber shall be approved by the Board of Review, American Lumber Standards Committee, to grade species used.

B. Sizes:

1. Lumber Size references, unless otherwise specified, are nominal sizes, and actual sizes shall be within manufacturing tolerances allowed by the standard under which product is produced.
2. Millwork, standing and running trim, and rails: Actual size as shown or specified.

C. Hardwood: MM-L-736, species as specified for each item.

D. Softwood: PS-20, exposed to view appearance grades:

1. Use C select or D select, vertical grain for transparent finish including stain transparent finish.
2. Use Primer for painted or opaque finish.

E. Use edge grain Wood members exposed to weather.

**2.2 PLYWOOD**

A. Softwood Plywood:

1. Prod. Std.
2. Grading and Marking:
  - a. Each sheet of plywood shall bear the mark of a recognized association or independent inspection agency that maintains continuing control over the quality of the plywood.
  - b. The mark shall identify the plywood by species group or

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identification index, and shall show glue type, grade, and compliance with PS1.

3. Plywood, 13 mm (1/2 inch) and thicker; not less than five ply construction, except 32 mm (1-1/4 inch) thick plywood not less than seven ply.
  4. Plastic Laminate Plywood Cores:
    - a. Exterior Type, and species group.
    - b. Veneer Grade: A-C.
  5. Shelving Plywood:
    - a. Interior Type, any species group.
    - b. Veneer Grade: A-B or B-C.
  6. Other: As specified for item.
- B. Hardwood Plywood:
1. HPVA: HP.1
  2. Species of face veneer shall be as shown or as specified in connection with each particular item.
  3. Inside of Building:
    - a. Use Type II (interior) A grade veneer for transparent finish.
    - b. Use Type II (interior) Sound Grade veneer for paint finish.
  4. Use plain sliced white birch unless specified otherwise.

**2.3 PARTICLEBOARD**

- A. NPA A208.1
- B. General Use: Type 1, Grade 1-M-3 or Type 2, Grade 2-M-2.

**2.4 PLASTIC LAMINATE**

- A. NEMA LD-3.
- B. Exposed decorative surfaces including countertops, both sides of cabinet doors, and for items having plastic laminate finish. General Purpose, Type HGL.
- C. Cabinet Interiors including Shelving: Both of following options to comply with NEMA, CLS as a minimum.
  1. Plastic laminate clad plywood or particle board.
- D. Backing sheet on bottom of plastic laminate covered wood tops: Backer, Type HGP.
- E. Post Forming Fabrication, Decorative Surfaces: Post forming, Type HGP.

**2.5 ADHESIVE**

- A. For Plastic Laminate: Fed. Spec. A-A-1936.
- B. For Interior Millwork: Unextended urea resin, phenol resin, or resorcinol resin.

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**2.6 HARDWARE**

**A. Rough Hardware:**

1. Furnish rough hardware with a standard plating, applied after punching, forming and assembly of parts; galvanized, cadmium plated, or zinc-coated by electric galvanizing process. Galvanized where specified.
2. Use galvanized coating on ferrous metal for exterior work unless non-ferrous metals or stainless is used.
3. Fasteners:
  - a. Bolts with Nuts: FF-N-836.
  - b. Expansion Bolts: A-A-1922A.
  - c. Screws: Fed. Spec. FF-S-111.

**B. Finish Hardware**

1. Cabinet Hardware: ANSI A156.9.
  - a. Door/Drawer Pulls: B02011. Door in seismic zones: B03182.
  - b. Heavy Duty Drawer Slides: B05051 for drawers over 150 mm (6 inches) deep, B05052 for drawers 75 mm to 150 mm (3 to 6 inches) deep, and B05053 for drawers less than 75 mm (3 inches) deep.
  - c. Sliding Door Tracks: B07063.
  - d. Adjustable Shelf Standards: B4061 with shelf rest B04083.
  - e. Concealed Hinges: B1601, minimum 110 degree opening.
  - f. Butt Hinges: B01361, for flush doors, B01381 for inset lipped doors, and B01521 for overlay doors.
  - g. Cabinet Door Catch: B0371 or B03172.
  - h. Vertical Slotted Shelf Standard: B04103 with shelf brackets B04113, sized for shelf depth.
  - i. Door Silencers: Pads attached to frame or door edge designed to dampen sound produced when door shut.
2. Cabinet Locks: ANSI A156.11.
  - a. Drawers and Hinged Door: E07262.
  - b. Sliding Door: E07162.
3. Auxiliary Hardware: ANSI A156.16.
  - a. Shelf Bracket: B04041, japanned or enameled finish.
  - b. Combination Garment rod and Shelf Support: B04051 japanned or enamel finish.
  - c. Closet Bar: L03131 chrome finish of required length.
4. Steel Channel Frame and Leg supports for Counter top. Fabricated under Section 05 50 00, METAL FABRICATIONS.
5. Pipe Bench Supports:
  - a. Pipe: ASTM A53.

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6. Fabricated Wall Bench Supports:

- a. Steel Angles: ASTM A36 steel with chrome finish, or ASTM A167, stainless steel with countersunk wood screws, holes at 64 mm (2-1/2 inches) on center on horizontal member.
- b. Use 38 mm by 38 mm by 5 mm (1-1/2 by 1-1/2 by 3/16 inch) angle thick drilled for screw and bolt holes unless shown otherwise. Drill 6 mm (1/4 inch) holes for anchors on vertical member, not more than 200 mm (8 inches) on center between ends or corners.
- c. Stainless steel bars brackets: ASTM A167, fabricated to shapes shown, Number 4 finish. Use 50 mm by 5 mm (2 inch by 3/16 inch) bars unless shown otherwise. Drill for anchors and screws. Drill countersunk wood screw holes at 64 mm (2-1/2 inches) on center on horizontal members and not less than two 13 mm (1/4 inch) hole for anchors on vertical member.

7. Thru-Wall Counter Brackets:

- a. Steel angles drilled for fasteners on 100 mm (4 inches) centers.
- b. Baked enamel prime coat finish.

8. Folding Shelf Bracket:

- a. Steel Shelf bracket, approximately 400 mm by 400 mm (16 by 16 inches), folding type with baked gray enamel finish or chrome plated finish.
- b. Bracket legs shall be approximately 28 mm (1-1/8 inches) wide.
- c. Distance from center line of hinge pin to back of vertical leg shall be 44 mm (1-3/4 inches) or provide for wood spacer if hinge line is at joint of vertical and horizontal leg.
- d. Distance from face to face of bracket when closed shall be 50 mm (2 inches).
- e. Brackets shall automatically lock when counter is raised parallel to floor and shall unlock manually.
- f. Each bracket shall support not less than 68 Kg (150 pounds) evenly distributed.

9. Edge Strips Moldings:

- a. Driven type "T" shape with serrated retaining stem; vinyl plastic to match plastic laminate color, stainless steel, or 3 mm (1/8 inch) thick extruded aluminum.
- b. Stainless steel or extruded aluminum channels.
- c. Stainless steel, number 4 finish; aluminum, mechanical applied medium satin finish, clear anodized 0.1 mm (0.4 mils) thick.

10. Worksurface Grommets: Stainless steel.

11. Primers: Manufacturer's standard primer for steel providing baked enamel finish.

**2.7 MOISTURE CONTENT**

A. Moisture content of lumber and millwork at time of delivery to site.

- 1. Interior finish lumber, trim, and millwork 32 mm (1-1/4 inches) or less in nominal thickness: 12 percent on 85 percent of the pieces



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and 15 percent on the remainder.

2. Moisture content of other materials shall be in accordance with the standards under which the products are produced.

**2.8 FIRE RETARDANT TREATMENT**

- A. Where wood members and plywood are specified to be fire retardant treated, the treatment shall be in accordance with Mil. Spec. MIL-L19140.
- B. Treatment and performance inspection shall be by an independent and qualified testing agency that establishes performance ratings.
- C. Each piece of treated material shall bear identification of the testing agency and shall indicate performance in accordance with such rating of flame spread and smoke developed.
- D. Treat wood for maximum flame spread of 25 and smoke developed of 25.
- E. Fire Resistant Softwood Plywood:
  1. Use Grade A, Exterior, plywood for treatment.
  2. Meet the following requirements when tested in accordance with ASTM E84.
    - a. Flame spread: 0 to 25.
    - b. Smoke developed: 100 maximum
- F. Fire Resistant Hardwood Plywood:
  1. Core: Fire retardant treated softwood plywood.
  2. Hardwood face and back veneers untreated,
  3. Factory seal panel edges, to prevent loss of fire retardant salts.

**2.9 ACRYLIC PANELS**

- A. Material: Co-polymer resin with 40 percent pre-consumer recycled content.
- B. Minimum Mechanical and Physical Properties:
  1. Density (ASTM D1505): 79 lbs per cu. ft. (1270 kg per cu. m).
  2. Tensile Stress (ASTM D 638):
    - a. Yield: 7,700 psi (53 MPa).
    - b. Break: 3,800 psi (26 MPa).
  3. Elongation (ASTM D 638):
    - a. Yield: 4.8 percent.
    - b. Break: 50 percent.
  4. Safety Glazing (ANSI 97.1): Pass.
  5. Flame Spread (ASTM E84): Less than 25.

**2.10 SOLID POLYMER MATERIAL**

- A. Solid Surfacing Material
  1. Composition of acrylic polymer and alumina trihydrate (ATH) or similar solid surfacing composition.

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2. Performance properties required:

Property	Result	Test
Elongation	0.4% min.	ASTM D638
Hardness	85 Rockwell M	ASTM D785
Impact resistance	No fracture	NEMA LD-3 900 mm (36") drop 1 kg 2 lb.) ball
Boiling water surface resistance	No visible change	NEMA LD3
High temperature	Slight surface dulling	NEMA LD3

3. Cast into sheet form and bowl form.
4. Color throughout with subtle veining through thickness.
5. Joint adhesive and sealer: Manufacturers silicone adhesive and sealant for joining methyl methacrylic polymer sheet.
6. Bio-based products will be preferred.

**2.11 FABRICATION**

A. General:

1. Except as otherwise specified, use AWI Custom Grade for architectural woodwork and interior millwork.
2. Finish woodwork shall be free from pitch pockets.
3. Except where special profiles are shown, trim shall be standard stock molding and members of the same species.
4. Plywood shall be not less than 13 mm (1/2 inch), unless otherwise shown or specified.
5. Edges of members in contact with concrete or masonry shall have a square corner caulking rebate.
6. Fabricate members less than 4 m (14 feet) in length from one piece of lumber, back channeled and molded as shown.
7. Interior trim and items of millwork to be painted may be fabricated from jointed, built-up, or laminated members, unless otherwise shown on drawings or specified.
8. Plastic Laminate Work:
  - a. Factory glued to either a plywood or a particle board core, thickness as shown or specified.
  - b. Cover exposed edges with plastic laminate, except where aluminum, stainless steel, or plastic molded edge strips are shown or specified. Use plastic molded edge strips on 19 mm (3/4-inch) molded thick or thinner core material.
  - c. Provide plastic backing sheet on underside of countertops, vanity tops, thru-wall counter including back splashes and end splashes of countertops.
  - d. Use backing sheet on concealed large panel surface when decorative face does not occur.

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**B. Mounting Strips, Shelves and Rods:**

1. Cut mounting strips from 25 mm by 100 mm (1 by 4 inches) softwood stock, with exposed edge slightly rounded.
2. Cut wood shelf from softwood 1 inch stock, of width shown, exposed edge slightly rounded. Option: Use 19 mm (3/4 inch) thick plywood with 19 mm (3/4 inch) softwood edge nosing on exposed edge, slightly rounded.
3. Plastic laminate covered, 19 mm (3/4 inch) thick plywood or particle board core with edges and ends having plastic molded edge strips. Size, finish and number as shown.

**PART 3 - EXECUTION**

**3.1 ENVIRONMENTAL REQUIREMENTS**

- A. Maintain work areas and storage areas to a minimum temperature of 21 deg C (70 deg F) for not less than 10 days before and during installation of interior millwork.
- B. Do not install finish lumber or millwork in any room or space where wet process systems such as concrete, masonry, or plaster work is not complete and dry.

**3.2 INSTALLATION**

**A. General:**

1. Millwork receiving transparent finish shall be primed and back-painted on concealed surfaces. Set no millwork until primed and back-painted.
2. Secure trim with fine finishing nails, screws, or glue as required.
3. Set nails for putty stopping. Use washers under bolt heads where no other bearing plate occurs.
4. Seal cut edges of preservative and fire retardant treated wood materials with a certified acceptable sealer.
5. Coordinate with plumbing and electrical work for installation of fixtures and service connections in millwork items.
6. Plumb and level items unless shown otherwise.
7. Nail finish at each blocking, lookout, or other nailer and intermediate points; toggle or expansion bolt in place where nails are not suitable.

**B. Shelves:**

1. Install mounting strip at back wall and end wall for shelves in closets where shown secured with toggle bolts at each end and not over 600 mm (24 inch) centers between ends.
  - a. Nail Shelf to mounting strip at ends and to back wall strip at not over 900 mm (36 inches) on center.
  - b. Install metal bracket, ANSI A156.16, B04041, not over 1200 mm (4 feet) centers when shelves exceed 1800 mm (6 feet) in length.
  - c. Install metal bracket, ANSI A156.16, B04051, not over 1200 mm (4 feet) on centers where shelf length exceeds 1800 mm (6 feet)

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in length with metal rods, clothes hanger bars ANSI A156.16, L03131, of required length, full length of shelf.

2. Install vertical slotted shelf standards, ANSI A156.9, B04103 to studs with toggle bolts through each fastener opening. Double slotted shelf standards may be used where adjacent shelves terminate.
  - a. Install brackets ANSI A156.9, B04113, providing supports for shelf not over 900 mm (36 inches) on center and within 13 mm (1/2 inch) of shelf end unless shown otherwise.
  - b. Install shelves on brackets so front edge is restrained by bracket.
- C. Install with butt joints in straight runs and miter at corners.

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SECTION 07 12 00

BUILT-UP BITUMINOUS WATERPROOFING

PART 1 - GENERAL

1.1 DESCRIPTION:

- A. This section specifies impervious built-up membranes of bituminous materials used for waterproofing.

1.2 PRODUCT DELIVERY, STORAGE AND HANDLING:

- A. Deliver materials to job in manufacturer's original unopened containers with brand name marked thereon.
- B. Before proceeding with work, protect surfaces from excessive changes in temperature and protect piping, conduits and installed equipment and materials.

1.3 APPLICABLE PUBLICATIONS:

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in text by basic designation only.
- B. American Society for Testing and Materials (ASTM):
  - 1. C208-08 Cellulosic Fiber Insulating Board
  - 2. D41-11 Asphalt Primer Used in Roofing, Dampproofing, and Waterproofing
  - 3. D173-03 Bitumen-Saturated Cotton Fabrics used in Roofing and Waterproofing
  - 4. D226-09 Asphalt-Saturated Organic Roofing Felt Used in Roofing and Waterproofing
  - 5. D449-03(R2009) Asphalt Used in Dampproofing and Waterproofing
  - 6. D1327-04 Bitumen-Saturated Woven Burlap Fabrics Used in Roofing and Waterproofing
  - 7. D1668-97(R2006) Glass Fabrics (Woven and Treated) for Roofing and Waterproofing
  - 8. D2178-04 Asphalt Glass Felt Used in Roofing and Waterproofing
  - 9. D4586-07 Asphalt Roof Cement, Asbestos-Free

PART 2 - EXECUTION:

2.1 PREPARATION:

- A. Do not apply waterproofing when ambient temperature is 4.4°C (40°F) or lower.
- B. Cleaning and Filling:
  - 1. Before applying waterproofing materials, clean surfaces smooth, firm and dry.

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2. Remove high spots, depressions, loose and foreign particles; and fill all voids, joints and cracks with Portland cement mortar.
3. Surface shall be approved by Resident Engineer before waterproofing is started.

**2.2 GENERAL:**

- A. Ventilation: Provide adequate ventilation for waterproofing installed in enclosed spaces.
- B. Compatibility of Materials: Use asphalt with asphalt-saturated felts and fabrics.
- C. Temperature of Bitumen: Heat bitumen to flow freely when applied, but not above 190°C (375°F) for coal-tar, and not above 230°C (450°F) for asphalt.
- D. Rate of Application: Apply primers at the rate of 0.4 L/m<sup>2</sup> (one gallon per 100 square feet) over concrete and parging. Apply asphalt at the rate of 1.5 kg/m<sup>2</sup> (30 pounds per 100 square feet), for each mopping.
- E. Number of Plies:
  1. Membrane waterproofing shall consist of four plies of felt or fabric.
  2. Install membrane by lapping each ply approximately three-quarters over the preceding ply.
  3. Use appropriate width starting strips of felt or fabric at the starting line to provide four plies at the edge.

**2.3 APPLICATION**

- A. Exterior Vertical Surfaces:
  1. Start each ply at the bottom, placed vertically, in hot bitumen and complete prior to applying the next ply.
  2. Overlap plies downward.
  3. Lap each ply 100 mm (4 inches) at the end. Stagger end laps not less than 450 mm (18 inches) in relation to preceding layer.
  4. Bitumen shall be applied to exterior vertical surfaces with cotton roller mops or other approved application devices.
  5. Waterproofing membranes shall be installed vertically, shingle fashion, in the manner specified herein.
  6. The membrane shall extend 50 mm (2 inches) from the outer edge of footing, across the top of the footing, and up foundation wall to approximately 100 mm (4 inches) below the finished grade.
  7. Tops of the membranes shall be [secured and protected as indicated] [nailed to treated wood nailers set flush with the face of the wall and covered with two piles of fabric reinforcement.] Nailing shall be 200 mm (8 inches) on centers on a line 38 mm (1-1/2 inches) below the top of the membranes.
- B. Fabric Membrane Reinforcement:
  1. Provide fabric membranes to reinforce felts at intersections.

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2. Reinforcement shall consist of two plies of fabric membrane cemented in place and to each other with roofing cement not less than 2 mm (1/16 inch) thick for each coating.
3. At the intersection of slabs and vertical surfaces, extend the first ply at least 150 mm (6 inches) on the slab and 100 mm (4 inches) up the vertical surface.
4. At Intersections of two vertical surfaces, extend the first ply at least 250 mm (10 inches) on each side of the intersection.
5. The second ply shall lap the first by not less than 50 mm (two inches).

**C. Keyed Joint Footings:**

1. Provide an asphaltic-coated 454 g (16-ounce) cold-rolled copper flashing sheet with joints soldered and neatly formed to the contours of keyed joints in foundation wall footings.
2. The flashing sheet shall extend a minimum of 250 mm (10 inches) beyond the inside edge of the footing and shall be bent down 100 mm (4 inches) on the outside of the footing.
3. Protect the flashing sheet until it is lapped by the waterproofing membranes for the subsurface floor slabs and foundation walls.

**D. Flashing Flanges:**

1. Prime flashing flanges of the sleeves of pipe and ducts penetrating the waterproofing membrane.
2. Allow primer to dry and strip flanges in with two fabric membrane collars cemented in place and to each other with bituminous plastic cement. The collars shall extend 100 mm and 150 mm (four and six inches), respectively, beyond the edge of the flanges, cover the flanges, and fit tight against the sleeve.
3. Waterproofing connecting with work exposed to the weather shall extend back of same, or be counter-flashed to form a watertight connection.

**E. Clamping Devices:**

1. At floor drains and elsewhere as indicated, extend membrane into clamping device set in heavy coating of bituminous roof cement and clamp securely.

**F. Reglets:**

1. Where indicated, install continuous reglets as specified in Section, 07 60 00, FLASHING AND SHEET METAL, to receive the exposed edges of membrane waterproofing.
2. After placement of waterproofing, completely fill reglets with bitumen.

**G. Wood Nailers:**

1. Where indicated, upper edges of membrane waterproofing shall be nailed to wood nailers and covered with two plies of fabric reinforcement.
2. Wood nailers are specified in Section 061000, ROUGH CARPENTRY.

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2.4 INSPECTION:

- A. Do not cover waterproofed surfaces by other materials or backfill until the work is approved by Resident Engineer.

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SECTION 07 21 13

THERMAL INSULATION

PART 1 - GENERAL

1.1 DESCRIPTION:

- A. This section specifies thermal and acoustical insulation for buildings.
- B. Acoustical insulation is identified by thickness and words "Acoustical Insulation".

1.2 SUBMITTALS:

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Manufacturer's Literature and Data:
  - 1. Insulation, each type used
  - 2. Adhesive, each type used.
  - 3. Tape

1.3 STORAGE AND HANDLING:

- A. Store insulation materials in weathertight enclosure.
- B. Protect insulation from damage from handling, weather and construction operations before, during, and after installation.

1.4 APPLICABLE PUBLICATIONS:

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by basic designation only.
- B. American Society for Testing and Materials (ASTM):
  - 1. C553-08 Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications
  - 2. C612-10 Mineral Fiber Block and Board Thermal Insulation
  - 3. C665-06 Mineral Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing

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4. E84-10 Surface Burning Characteristics of Building Materials

**PART 2 - PRODUCTS**

**2.1 INSULATION - GENERAL:**

- A. Where more than one type of insulation is specified, the type of insulation for each use is optional, except use only one type of insulation in any particular area.
- B. Insulation Products shall comply with following minimum content standards for recovered materials:

Material Type	Percent by Weight
Perlite composite board	23 percent post consumer recovered paper
Polyisocyanurate/ polyurethane	
Rigid foam	9 percent recovered material
Foam-in-place	5 percent recovered material
Glass fiber reinforced	6 percent recovered material
Phenolic rigid foam	5 percent recovered material

**2.2 RIGID INSULATION:**

- A. Mineral Fiber Board: ASTM C612, Type IB or 2.

**2.3 FASTENERS:**

- A. Staples or Nails: ASTM F1667, zinc-coated, size and type best suited for purpose.
- B. Screws: ASTM C954 or C1002, size and length best suited for purpose with washer not less than 50 mm (two inches) in diameter.
- C. Impaling Pins: Steel pins with head not less than 50 mm (two inches) in diameter with adhesive for anchorage to substrate. Provide impaling pins of length to extend beyond insulation and retain cap washer when washer is placed on the pin.

**PART 3 - EXECUTION**

**3.1 INSTALLATION - GENERAL**

- A. Install insulation with the vapor barrier facing the heated side,

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unless specified otherwise.

- B. Install rigid insulating units with joints close and flush, in regular courses and with cross joints broken.
- C. Install batt or blanket insulation with tight joints and filling framing void completely. Seal cuts, tears, and unlapped joints with tape.
- D. Fit insulation tight against adjoining construction and penetrations, unless specified otherwise.

**3.2 ACOUSTICAL INSULATION:**

- A. Fasten blanket insulation between metal studs and wall furring with continuous pressure sensitive tape along edges or adhesive.
- B. Pack insulation around door frames and windows and in cracks, expansion joints, control joints, door soffits and other voids. Pack behind outlets, around pipes, ducts, and services encased in wall or partition. Hold insulation in place with pressure sensitive tape or adhesive.
- C. Do not compress insulation below required thickness except where embedded items prevent required thickness.
- D. Where acoustical insulation is installed above suspended ceilings install blanket at right angles to the main runners or framing. Extend insulation over wall insulation systems not extending to structure above.
- E. Where semirigid insulation is used which is not full thickness of cavity, adhere to one side of cavity maintaining continuity of insulation and covering penetrations or embedments in insulation.
- F. Where sound deadening board is shown, secure with screws to metal or wood framing. Secure sufficiently in place until subsequent cover is installed. Seal all cracks with caulking.

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SECTION 07 40 00

ROOFING AND SIDING PANELS

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This section specifies metal wall panels as shown.

1.2 RELATED WORK

- A. Sealant: Section 07 9 200, JOINT SEALANTS.
- B. Insulation: Section 07 21 13 - THERMAL INSULATION.

1.3 MANUFACTURER'S QUALIFICATIONS

- A. Metal wall panels of the type and design shown and specified.

1.4 SUBMITTALS

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Samples: Metal panel, 150 mm (six inch) square, showing finish, each color and texture.
- C. Shop Drawings: Wall and roof panels, showing details of construction and installation. Collateral steel framing thickness and kind of material, closures, flashing, fastenings and related components and accessories.
- D. Manufacturer's Literature and Data: Wall and roof panels

1.5 APPLICABLE PUBLICATIONS

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.
- B. American Society for Testing and Materials (ASTM):
  - 1. A653/A653M-10 Steel Sheet, Zinc-Coated (Galvanized), or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
  - 2. A463-10 Steel Sheet, Cold-Rolled, Aluminum-Coated, by the Hot-Dip Process
  - 3. A924/A924M-10 Steel Sheet, Metallic Coated by the Hot-Dip Process
  - 4. A1008/A1008M-10 Steel, Sheet, Cold-Rolled, Carbon, Structural, High Strength Low Alloy
  - 5. B209/209M-07 Aluminum and Aluminum Alloy Sheet and Plate
  - 6. C1396-11 Standard Specification for Gypsum Board
  - 7. C553-08 Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications
  - 8. C591-09. Unfaced Preformed Rigid Cellular Polyisocyanurate Thermal Insulation
  - 9. C612-10 Mineral Fiber Block and Board Thermal Insulation

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10. E119-10 Fire Test of Building Construction and Materials

**PART 2 - PRODUCTS**

**2.1 SHEET STEEL**

- A. Minimum 0.8mm thick for wall and roof panels.
- B. Steel, Sheet, Galvanized: ASTM A653/A653M, Structural.
  - 1. Grade 40, galvanized coating conforming to ASTM A924/A924M, Class Z 275 G-90.

**2.2 ALUMINUM PLATE AND SHEET**

- A. ASTM B209/209M

**2.3 FASTENERS**

- A. Fasteners for steel panels shall be galvanized or cadmium plated steel.
- B. Fasteners for aluminum panels shall be aluminum or stainless steel.
- C. Fasteners of size, type and holding strength as recommended by manufacturer.

**2.4 FABRICATION**

- A. Uninsulated metal wall panels shall be single sheets, of approximate overall depth and configuration shown on drawings. Connection between panels shall be by interlocking joints filled with sealing compound as specified in Section 079200, JOINT SEALANTS. Furnish wall panels in one continuous length for full height or at least one story height with no horizontal joints, except at openings. Construct panels as follows:
  - 1. Wall panels:
    - a. 0.032 inch thick aluminum.
    - b. 0.0336 inch thick galvanized steel.
  - 2. Accessories and flashing shall be the same material as the panels. Thickness and installation of accessories and flashing shall be as recommended by the panel manufacturer.

**2.5 FINISH**

- A. For uninsulated wall panels, the finishes shall be as follows for aluminum face sheets:
  - 1. AA-R1X finish Fluoropolymer enamel finish, consisting of a chemical pre-treatment of the base aluminum; then applying a primer coat of 0.1 to 0.4 mil dry film thickness; a polyvinylidene fluoride resin finish coat of 0.8 mil minimum dry film thickness on one side, and a wash coat of 0.3 to 0.4 mil minimum dry film thickness applied to reverse side.
  - 2. AA-R2X finish- Baked-on enamel finish, consisting of a chemical pre-treatment of the base aluminum; then applying a primer coat and a protective coat applied to reverse side.

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3. AA-R3X finish - Acrylic film finish, consisting of an acrylic primer in solid film formed of two to three mil thickness bonded to the base aluminum.
  4. AA-M10C22A31 finish - (Unspecified) as fabricated, chemically etched medium matte finish, clear anodized 0.4 mil thick.
  5. AA-M10C22A41 finish- (Unspecified) as fabricated, chemically etched medium matte finish, clear anodized 0.7 mil thick.
  6. AA-M10C22A32 finish - (Unspecified) as fabricated, chemically etched medium matte finish, integral color anodized 0.4 mil thick.
  7. AA-M10C22A42 finish - (Unspecified) as fabricated, chemically etched medium matte finish, integral color anodized 0.7 mil thick.
  8. AA-M10 finish- (Unspecified) as fabricated [and field painted] for interior liner face sheet for insulated wall panels.
- B. For steel face sheets, the finishes shall be as follows:
1. Silicone polyester finish, consisting of a chemical pre-treatment of the galvanized steel [or uncoated steel], then applying an epoxy prime coat of 0.2 mil minimum dry film thickness; then a silicone polyester finish coat of 0.8 mil minimum dry film thickness on one side and polyester prime coat of 0.5 mil minimum dry film thickness applied to reverse side.
  2. Acrylic film finish, consisting of an acrylic polymer in solid film formed of two to three mil thickness bonded to the galvanized steel [or uncoated steel].
  3. Vinyl coated finish, consisting of a chemical pre-treatment of the galvanized steel [or uncoated steel], then applying a vinyl resin prime and finish coats. Dry film thickness shall be 1.50 to 1.75 mil on each side.
  4. Fluorocarbon finish, consisting of a prime coat and a polyvinylidene fluoride finish coat of 1.0 mil minimum dry film thickness on one side, and a wash coat of 0.5 mil minimum dry film thickness applied to reverse side.
  5. Baked-on enamel prime coat 0.5 mil thick for steel interior liner face sheet for insulated wall panels.
- C. Finish numbers for aluminum specified herein are in accordance with The Aluminum Association's Designation System. Each aluminum finish number preceded by letters AA identifies it as an Aluminum Association designation.
- D. Aluminum alloy used for color coating shall be as required to produce specified color. Color shall be as selected by Architect. Color for sheet aluminum shall not deviate more than the colors of extrusion samples.

**PART 3 - EXECUTION**

**3.1 INSTALLATION**

- A. General: Install panels in accordance with the manufacturer's approved erection instructions and diagrams, except as specified otherwise. Panels shall be in full and firm contact with supports and with each other at side and end laps. Where panels are cut in the field,

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or where any of the factory applied coverings or coatings are abraded or damaged in handling or installation, they shall, after the necessary repairs have been made with material of the same type and color as the weather coating, be approved before being installed. All cut ends and edges, including those at openings through the sheets shall be sealed completely. Correct defects or errors in the materials in an approved manner. Replace materials which cannot be corrected in an approved manner with non-defective material. Provide molded closure strips where indicated and whenever sheets terminate with open ends after installation.

- B. Wall Panels: Apply panels with the configuration in a vertical position. Provide panels in [the longest obtainable lengths, with end laps occurring only at structural members] [full heights from base to eave with no horizontal joints except at the junctions of door frames, window frames, louver panels, and similar locations.] Seal side and end laps with joint sealing material. Flash and seal walls at the base, at the top, around windows, door frames, framed louvers, and other similar openings. Install closure strips, flashings, and sealing material in an approved manner that will assure complete weather tightness. Flashing will not be required where approved "self-flashing" panels are used.
- C. Flashing: All flashing and related closures and accessories in connection with the preformed metal panels shall be provided as indicated and as necessary to provide a watertight installation. Details of installation, which are not indicated, shall be in accordance with the panel manufacturer's printed instruction and details, or the approved shop drawings. Installation shall allow for expansion and contraction of flashing.
- D. Fasteners: Fastener spacings shall be in accordance with the manufacturer's recommendations, and as necessary to withstand the design loads indicated. Install fasteners in valleys or crowns as recommended by the manufacturer of the sheet being used. Install fasteners in straight lines within a tolerance of 13 mm (1/2-inch) in the length of a bay. Drive exposed penetrating type fasteners normal to the surface, and to a uniform depth to seat gasketed washers properly, and drive so as not to damage factory applied coating. Exercise extreme care in drilling pilot holes for fastenings to keep drills perpendicular and centered in valleys, or crowns, as applicable. After drilling, remove metal filings and burrs from holes prior to installing fasteners and washers. Torque used in applying fasteners shall not exceed that recommended by the manufacturer. Remove panels deformed or otherwise damaged by over-torqued fastenings, and provide new panels. Remove metal shavings and filings from roofs on completion to prevent rusting and discoloration of the panels.

### **3.2 ISOLATION OF ALUMINUM**

- A. Isolate aluminum in contact with or fastened to dissimilar metals other than stainless steel, white bronze, or other metal compatible with aluminum by one of the following:
  - 1. Painting the dissimilar metal with a prime coat of Zinc-Molybdate followed by two coats of aluminum paint.



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2. Placing a non-abrasive tape or gasket between the aluminum and the dissimilar metal.
- B. Paint aluminum in contact with or built into mortar, concrete, plaster, or other masonry materials with a coat of alkali-resistant bituminous paint.
- C. Paint aluminum in contact with wood or other absorptive materials, that may become repeatedly wet, with two coats of bituminous paint, or two coats of aluminum paint. Seal joints with caulking material.

**3.3 PROTECTION AND CLEANING**

- A. Protect panels and other components from damage during and after erection, and until project is accepted by the Government.
- B. After completion of work, all exposed finished surfaces of panels shall be cleaned of soil, discoloration and disfiguration. Touch-up abraded surfaces of panels.

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SECTION 07 81 00

APPLIED FIREPROOFING

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This section specifies cementitious coverings to provide fire resistance to interior structural steel members shown.

1.2 SUBMITTALS

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

- B. Manufacturer's Literature and Data:

- 1. Manufacturer's complete and detailed application instructions and specifications.
  - 2. Manufacturer's repair and patching instructions.

- C. Certificates:

- 1. Certificate from testing laboratory attesting fireproofing material and application method meet the specified fire ratings.
    - a. List thickness and density of material required to meet fire ratings.
    - b. Accompanied by complete test report and test record.
  - 2. Manufacturer's certificate indicating sprayed-on fireproofing material supplied under the Contract is same within manufacturing tolerance as fireproofing material tested.

- D. Miscellaneous:

- 1. Manufacturer's written approval of surfaces to receive sprayed-on fireproofing.
  - 2. Manufacturer's written approval of completed installation.
  - 3. Manufacturer's written approval of the applicators of fireproofing material.

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**1.3 PRODUCT DELIVERY, STORAGE AND HANDLING**

- A. Deliver to job-site in sealed containers marked and labeled to show manufacturer's name and brand and certification of compliance with the specified requirements.
- B. Remove damaged containers from the site.
- C. Store the materials off the ground, under cover, away from damp surfaces.
- D. Keep dry until ready for use.
- E. Remove materials that have been exposed to water before installation from the site.

**1.4 QUALITY CONTROL**

- A. Test for fire endurance in accordance with ASTM E119, for fire rating specified, in a nationally recognized laboratory.
- B. Manufacturer's inspection and approval of surfaces to receive fireproofing as specified under paragraph Examination.
- C. Manufacturer's approval of fireproofing applications.
- D. Manufacturer's approval of completed installation.
- E. Manufacturer's representative shall observe and advise at the commencement of application, and shall visit the site as required thereafter for the purpose of ascertaining proper application.
- F. Pre-Application Test Area.
  - 1. Apply a test area consisting of a typical overhead fireproofing installation, including not less than 4.5 m (15 feet) of beam and deck.
    - a. Apply to one column.
    - b. Apply for the hourly ratings used.
  - 2. Install in location selected by the Resident Engineer, for approval by the representative of the fireproofing material manufacturer and by the Government.
  - 3. Perform Bond test on painted steel in accordance with ASTM E736.

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4. Do not proceed in other areas until installation of test area has been completed and approved.
5. Keep approved installation area open for observation as criteria for sprayed-on fireproofing.

**1.5 APPLICABLE PUBLICATIONS**

A. Publications listed below form a part of this specification to the extent referenced. Publications are referenced in the text by the basic designation only.

B. American Society for Testing and Materials (ASTM):

1. C841-03(R2008) Installation of Interior Lathing and Furring
2. C847-10 Metal Lath
3. E84-10 Surface Burning Characteristics of Building Materials
4. E119-10 Fire Tests of Building Construction and Materials
5. E736-00(R2006) Cohesion/Adhesion of Sprayed Fire-Resistive Materials Applied to Structural Members
6. E759-92(R2005) The Effect of Deflection on Sprayed Fire-Resistive Material Applied to Structural Members
7. E760-92(R2005) Impact on Bonding of Sprayed Fire-Resistive Material Applied to Structural Members
8. E761-92(R2005) Compressive Strength of Fire-Resistive Material Applied to Structural Members
9. E859-93(R2006) Air Erosion of Sprayed Fire-Resistive Materials Applied to Structural Members
10. E937-93(R2005) Corrosion of Steel by Sprayed Fire-Resistive Material Applied to Structural Members
11. E1042-02(R2008) Acoustically, Absorptive Materials Applied by Trowel or Spray.
12. G21-09 Determining Resistance of Synthetic Polymeric Materials to Fungi

C. Underwriters Laboratories, Inc. (UL):

1. Fire Resistance Directory...Latest Edition including Supplements

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D. Warnock Hersey (WH):

1. Certification Listings Latest Edition

E. Factory Mutual System (FM):

1. Approval Guide Latest Edition including Supplements

**PART 2 - PRODUCTS**

**2.1 SPRAYED-ON FIREPROOFING**

A. ASTM E1042, Class (a), Category A.

1. Type I, factory mixed cementitious materials with approved aggregate.

B. Materials containing asbestos are not permitted.

C. Fireproofing characteristics when applied in the thickness and density required to achieve the fire-rating specified.

	Characteristic	Test	Results
1.	Deflection	ASTM E759	No cracking, spalling, or delamination when backing to which it is applied has a deflection up to 1/120 in 3m (10 ft.)
2.	Corrosion-Resistance	ASTM E937	No promotion of corrosion of steel.
3.	Bond Impact	ASTM E760	No cracking, spalling, or delamination.
4.	Cohesion/Adhesion (Bond Strength)	ASTM E736	Minimum cohesive/adhesive strength of 9.57 kPa (200 lbf/ft <sup>2</sup> ) for protected areas. 19.15 kPa (400 lbf/ft <sup>2</sup> ) for exposed areas.
5.	Air Erosion	ASTM E859	Maximum gain weight of the collecting filter 0.27gm/m <sup>2</sup> (0.025 gm/ft <sup>2</sup> ).
6.	Compressive Strength	ASTM E761	Minimum compressive strength 48 kPa (1000psf).

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7.	Surface Burning Characteristics with adhesive and sealer to be used	ASTM E84	Flame spread 25 or less smoke developed 50 or less
8.	Fungi Resistance	ASTM G21	Resistance to mold growth when inoculated with aspergillus niger (28 days for general application)

**2.2 WATER**

- A. Clean, fresh, and free from organic and mineral impurities.
- B. pH of 6.9 to 7.1.

**2.3 MECHANICAL BOND MATERIAL**

- A. Expanded Metal Lath: ASTM C847, minimum weight of 0.92 kg/m<sup>2</sup> (1.7 pounds per square yard).
- B. Fasteners: ASTM C841.

**PART 3 - EXECUTION**

**3.1 EXAMINATION**

- A. Verify surfaces to receive fireproofing are clean and free of dust, soot, oil, grease, water soluble materials or any foreign substance which would prevent adhesion of the fireproofing material.
- B. Verify hangers, inserts and clips are installed before the application of fireproofing material.
- C. Verify ductwork, piping, and other obstructing material and equipment is not installed that will interfere with fireproofing installation.
- D. Verify concrete work on steel decking and concrete encased steel is completed.
- E. Verify temperature and enclosure conditions are required by fire-proofing material manufacturer.

**3.2 APPLICATION**

- A. Do not start application until written approval has been obtained from

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manufacturer of fireproofing materials that surfaces have been inspected by the manufacturer or his representative, and are suitable to receive sprayed-on fireproofing.

B. Coordinate application of fireproofing material with other trades.

C. Application of Metal Lath:

1. Apply to beam and columns having painted surfaces which fail ASTM E736 Bond Test requirements in pre-application test area.
2. Apply to beam flanges 300 mm (12-inches) or more in width.
3. Apply to column flanges 400 mm (16-inches) or more in width.
4. Apply to beam or column web 400 mm (16-inches) or more in depth.
5. Tack weld or mechanically fasten on maximum of 300 mm (12-inch) center.
6. Lap and tie lath member in accordance with ASTM C841.

D. Mix and apply in accordance with manufacturer's instructions.

1. Mechanically control material and water ratios.
2. Apply adhesive and sealer, when not an integral part of the materials, in accordance with the manufacturer's instructions.
3. Apply to density and thickness indicated in UL Fire Resistance Directory, FM Approval Guide, or WH Certification Listings unless specified otherwise. Test in accordance with ASTM E119.
4. Minimum applied dry density per cubic meter (cubic foot) for the underside of the walk on deck (interstitial) hung purl in or beam and steel deck, columns in interstitial spaces and mechanical equipment rooms shall be as follows:
  - a. Type I -  $240 \text{ kg/m}^3$  (15 lb/ft<sup>3</sup>).
  - b. Materials with higher density of  $640 \text{ kg/m}^3$  (40pcf) maybe used in some mechanical rooms or parking garages.

E. Application shall be completed in one area, inspected and approved by Resident Engineer before removal of application equipment and proceeding with further work.



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**3.3 FIELD TESTS**

- A. Tests of applied material will be performed by VA retained Testing Laboratory. See Section 01 45 29, TESTING LABORATORY SERVICES.
- B. Resident Engineer will select area to be tested in specific bays on each floor using a geometric grid pattern.
- C. Test for thickness and density in accordance with ASTM E605. Areas showing thickness less than that required as a result of fire endurance test will be rejected.
- D. Areas showing less than required fireproofing characteristics will be rejected on the following field tests.
  - 1. Test for cohesion/adhesion: ASTM E736.
  - 2. Test for bond impact strength: ASTM E760.

**3.4 PATCHING AND REPAIRING**

- A. Inspect after mechanical, electrical and other trades have completed work in contact with fireproofing material, but before sprayed material is covered by subsequent construction.
- B. Perform corrective measures in accordance with fireproofing material Manufacturer's recommendations.
  - 1. Respray areas requiring additional fireproofing material to provide the required thickness, and replace dislodged or removed material.
  - 2. Spray material for patching by machine directly on point to be patched, or into a container and then hand apply.
  - 3. Hand mixing of material is not permitted.
- C. Repair:
  - 1. Respray all test and rejected areas.
  - 2. Patch fireproofing material which is removed or disturbed after approval.
- D. Perform final inspection of sprayed areas after patching and repair.

**3.5 SCHEDULE**

- A. Apply fireproofing material in interior structural steel members and

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on underside of interior steel floor and roof decks, except on following surfaces:

1. Structural steel and underside of steel decks in elevator or dumbwaiter machine rooms.
2. Steel members in elevator hoist ways.
3. Areas used as air handling plenums.
4. Steel to be encased in concrete or designated to receive other type of fireproofing.

**B. Type I:**

1. One hour fire rating.
2. Two hour fire rating.
3. Three hour fire rating.

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SECTION 07 84 00

FIRESTOPPING

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Closures of openings in walls and floors against penetration of flame, heat, and smoke or gases in fire resistant rated construction.
- B. Closure of openings in walls against penetration of gases or smoke in smoke partitions.

1.2 RELATED WORK

- A. Spray applied fireproofing: Section 07 81 00, APPLIED FIREPROOFING
- B. Sealants and application: Section 07 92 00, JOINT SEALANTS.
- C. Fire and smoke damper assemblies in ductwork: Division 23.

1.3 SUBMITTALS

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Manufacturer's literature, data, and installation instructions for types of firestopping and smoke stopping used, including MSDS reports.
- C. List of FM, UL, or WH classification number of systems installed.
- D. Certified laboratory test reports for ASTM E814 tests for systems not listed by FM, UL, or WH proposed for use.

1.4 DELIVERY AND STORAGE

- A. Deliver materials in their original unopened containers with manufacturer's name and product identification.
- B. Store in a location providing protection from damage and exposure to the elements.

1.5 WARRANTY

- A. Firestopping work subject to the terms of the Article "Warranty of Construction", FAR clause 52.246-21, except extend the warranty period to five years.

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**1.6 QUALITY ASSURANCE**

- A. FM, UL, or WH or other approved laboratory tested products will be acceptable.

**1.7 APPLICABLE PUBLICATIONS**

- A. Publications listed below form a part of this specification to the extent referenced. Publications are referenced in the text by the basic designation only.
- B. American Society for Testing and Materials (ASTM):
  - 1. E84-10 Surface Burning Characteristics of Building Materials
  - 2. E814-11 Fire Tests of Through-Penetration Fire Stops
- C. Factory Mutual Engineering and Research Corporation (FM):
- D. Annual Issue Approval Guide Building Materials
- E. Underwriters Laboratories, Inc. (UL):
- F. Annual Issue Building Materials Directory
- G. Annual Issue Fire Resistance Directory
  - 1. 1479-10 Fire Tests of Through-Penetration Firestops
- H. Warnock Hersey (WH):
- I. Annual Issue Certification Listings

**PART 2 - PRODUCTS**

**2.1 FIRESTOP SYSTEMS**

- A. Use either factory built (Firestop Devices) or field erected (through-Penetration Firestop Systems) to form a specific building system maintaining required integrity of the fire barrier and stop the passage of gases or smoke.
- B. Through-penetration firestop systems and firestop devices tested in accordance with ASTM E814 or UL 1479 using the "F" or "T" rating to maintain the same rating and integrity as the fire barrier being sealed. "T" ratings are not required for penetrations smaller than or equal to 100 mm (4 in) nominal pipe or 0.01 m<sup>2</sup> (16 sq. in.) in overall cross sectional area.

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- C. Products requiring heat activation to seal an opening by its intumescence shall exhibit a demonstrated ability to function as designed to maintain the fire barrier.
- D. Firestop sealants used for firestopping or smoke sealing shall have following properties:
  - 1. Contain no flammable or toxic solvents.
  - 2. Have no dangerous or flammable out gassing during the drying or curing of products and have low-VOC or no-VOC outgassing onew firestopping reaches solid state.
  - 3. Water-resistant after drying or curing and unaffected by high humidity, condensation or transient water exposure.
  - 4. When used in exposed areas, shall be capable of being sanded and finished with similar surface treatments as used on the surrounding wall or floor surface.
- E. Firestopping system or devices used for penetrations by glass pipe, plastic pipe or conduits, unenclosed cables, or other non-metallic materials shall have following properties:
  - 1. Classified for use with the particular type of penetrating material used.
  - 2. Penetrations containing loose electrical cables, computer data cables, and communications cables protected using firestopping systems that allow unrestricted cable changes without damage to the seal.
  - 3. Intumescent products which would expand to seal the opening and act as fire, smoke, toxic fumes, and, water sealant.
- F. Control Voltage, Communications and Electronic Safety and Security Cable Penetrations in Fire-Resistance-Rated Walls and Smoke Barriers: Provide penetration firestopping with ratings described in this Section and with the ability to add or remove cables without the need for replacing fill materials.
  - 1. Provide collars and plates required for mounting single and multiple devices adjacent to each other.

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2. Accessories: Provide following accessories required for applications indicated on Drawings:
  - a. Extension module increasing effective length.
  - b. Radius control module providing minimum bend radius for twisted pair cables.
  - c. Multi-gang wall bracket to allow one to five pathways in finished wall to be supported from stud.
  - d. Modular floor grid system allowing banks of pathways in floor.
  - e. T-rating accessory kit.
  - f. Caps for unoccupied wall bracket gangs to allow future capacity.
- G. Maximum flame spread of 25 and smoke development of 50 when tested in accordance with ASTM E84.
- H. FM, UL, or WH rated or tested by an approved laboratory in accordance with ASTM E814.
- I. Materials to be asbestos free.

**PART 3 - EXECUTION**

**3.1 EXAMINATION**

- A. Submit product data and installation instructions, as required by article, submittals, after an onsite examination of areas to receive firestopping.

**3.2 PREPARATION**

- A. Remove dirt, grease, oil, loose materials, or other substances that prevent adherence and bonding or application of the firestopping or smoke stopping materials.
- B. Remove insulation on insulated pipe for a distance of 150 mm (six inches) on either side of the fire rated assembly prior to applying the firestopping materials unless the firestopping materials are tested and approved for use on insulated pipes.

**3.3 INSTALLATION**

- A. Do not begin work until the specified material data and installation

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instructions of the proposed firestopping systems have been submitted and approved.

- B. Install firestopping systems with smoke stopping in accordance with FM, UL, WH, or other approved system details and installation instructions.
- C. Install smoke stopping seals in smoke partitions.

**3.4 CLEAN-UP AND ACCEPTANCE OF WORK**

- A. As work on each floor is completed, remove materials, litter, and debris.
- B. Do not move materials and equipment to the next-scheduled work area until completed work is inspected and accepted by the Resident Engineer.
- C. Clean up spills of liquid type materials.

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SECTION 07 92 00

JOINT SEALANTS

PART 1 - GENERAL

1.1 DESCRIPTION:

- A. Section covers all sealant and caulking materials and their application, wherever required for complete installation of building materials or systems.

1.2 RELATED WORK:

- A. Firestopping penetrations: Section 07 84 00, FIRESTOPPING.
- B. Glazing: Section 08 80 00, GLAZING.
- C. Sound rated gypsum partitions/sound sealants: Section 09 29 00, GYPSUM BOARD.

1.3 QUALITY CONTROL:

- A. Installer Qualifications: An experienced installer who has specialized in installing joint sealants similar in material, design, and extent to those indicated for this Project and whose work has resulted in joint-sealant installations with a record of successful in-service performance.
- B. Source Limitations: Obtain each type of joint sealant through one source from a single manufacturer.
- C. Product Testing: Obtain test results from a qualified testing agency based on testing current sealant formulations within a 12-month period.
  - 1. Testing Agency Qualifications: An independent testing agency qualified according to ASTM C1021.
  - 2. Test elastomeric joint sealants for compliance with requirements specified by reference to ASTM C920, and where applicable, to other standard test methods.
  - 3. Test elastomeric joint sealants according to SWRI's Sealant Validation Program for compliance with requirements specified by

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reference to ASTM C920 for adhesion and cohesion under cyclic movement, adhesion-in peel, and indentation hardness.

4. Test other joint sealants for compliance with requirements indicated by referencing standard specifications and test methods.
5. Preconstruction Field-Adhesion Testing: Before installing elastomeric sealants, field test their adhesion to joint substrates in accordance with sealant manufacturer's recommendations:
6. Locate test joints where indicated or, if not indicated, as directed by Contracting Officer.
7. Conduct field tests for each application indicated below:
  - a. Each type of elastomeric sealant and joint substrate indicated.
  - b. Each type of non-elastomeric sealant and joint substrate indicated.
8. Notify Resident Engineer seven days in advance of dates and times when test joints will be erected.
- D. Arrange for tests to take place with joint sealant manufacturer's technical representative present.
- E. VOC: Acrylic latex and Silicon sealants shall have less than 50g/l VOC content.
- F. Mockups: Before installing joint sealants, apply elastomeric sealants as follows to verify selections made under sample Submittals and to demonstrate aesthetic effects and qualities of materials and execution:
  1. Joints in mockups of assemblies specified in other sections that are indicated to receive elastomeric joint sealants, which are specified by reference to this section.

**1.4 SUBMITTALS:**

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Manufacturer's installation instructions for each product used.

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C. Cured samples of exposed sealants for each color where required to match adjacent material.

D. Manufacturer's Literature and Data:

1. Caulking compound
2. Primers
3. Sealing compound, each type, including compatibility when different sealants are in contact with each other.
4. MSDS information.

**1.5 PROJECT CONDITIONS:**

A. Environmental Limitations:

1. Do not proceed with installation of joint sealants under following conditions:

- a. When ambient and substrate temperature conditions are outside limits permitted by joint sealant manufacturer or are below 4.4 °C (40 °F).
- b. When joint substrates are wet.

B. Joint-Width Conditions:

1. Do not proceed with installation of joint sealants where joint widths are less than those allowed by joint sealant manufacturer for applications indicated.

C. Joint-Substrate Conditions:

1. Do not proceed with installation of joint sealants until contaminants capable of interfering with adhesion are removed from joint substrates.

**1.6 DELIVERY, HANDLING, AND STORAGE:**

A. Deliver materials in manufacturers' original unopened containers, with brand names, date of manufacture, shelf life, and material designation clearly marked thereon.

B. Carefully handle and store to prevent inclusion of foreign materials.

C. Do not subject to sustained temperatures exceeding 32° C (90° F) or less than 5° C (40° F).

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**1.7 DEFINITIONS:**

- A. Definitions of terms in accordance with ASTM C717 and as specified.
- B. Back-up Rod: A type of sealant backing.
- C. Bond Breakers: A type of sealant backing.
- D. Filler: A sealant backing used behind a back-up rod.

**1.8 WARRANTY:**

- A. Warranty exterior sealing against leaks, adhesion, and cohesive failure, and subject to terms of "Warranty of Construction", FAR clause 52.246-21, except that warranty period shall be extended to two years.
- B. General Warranty: Special warranty specified in this Article shall not deprive Government of other rights Government may have under other provisions of Contract Documents and shall be in addition to, and run concurrent with, other warranties made by Contractor under requirements of Contract Documents.

**1.9 APPLICABLE PUBLICATIONS:**

- A. Publications listed below form a part of this specification to extent referenced. Publications are referenced in text by basic designation only.
- B. American Society for Testing and Materials (ASTM):
  - 1. C509-06 Elastomeric Cellular Preformed Gasket and Sealing Material.
  - 2. C612-10 Mineral Fiber Block and Board Thermal Insulation.
  - 3. C717-10 Standard Terminology of Building Seals and Sealants.
  - 4. C834-10 Latex Sealants.
  - 5. C919-08. Use of Sealants in Acoustical Applications.
  - 6. C920-10 Elastomeric Joint Sealants.
  - 7. C1021-08 Laboratories Engaged in Testing of Building Sealants.
  - 8. C1193-09 Standard Guide for Use of Joint Sealants.
  - 9. C1330-02 (R2007) Cylindrical Sealant Backing for Use with Cold Liquid Applied Sealants.

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10. D1056-07 Specification for Flexible Cellular  
Materials-Sponge or Expanded Rubber.

11. E84-09 Surface Burning Characteristics of Building  
Materials.

C. Sealant, Waterproofing and Restoration Institute (SWRI).

D. The Professionals' Guide

**PART 2 - PRODUCTS**

**2.1 SEALANTS:**

A. S-1:

1. ASTM C920, polyurethane or polysulfide.
2. Type M.
3. Class 25.
4. Grade NS.
5. Shore A hardness of 20-40

B. S-2:

1. ASTM C920, polyurethane or polysulfide.
2. Type M.
3. Class 25.
4. Grade P.
5. Shore A hardness of 25-40.

C. S-3:

1. ASTM C920, polyurethane or polysulfide.
2. Type S.
3. Class 25, joint movement range of plus or minus 50 percent.
4. Grade NS.
5. Shore A hardness of 15-25.
6. Minimum elongation of 700 percent.

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D. S-4:

1. ASTM C920 polyurethane or polysulfide.
2. Type S.
3. Class 25.
4. Grade NS.
5. Shore A hardness of 25-40.

E. S-5:

1. ASTM C920, polyurethane or polysulfide.
2. Type S.
3. Class 25.
4. Grade P.
5. Shore hardness of 15-45.

F. S-6:

1. ASTM C920, silicone, neutral cure.
2. Type S.
3. Class: Joint movement range of plus 100 percent to minus 50 percent.
4. Grade NS.
5. Shore A hardness of 15-20.
6. Minimum elongation of 1200 percent.

G. S-7:

1. ASTM C920, silicone, neutral cure.
2. Type S.
3. Class 25.
4. Grade NS.
5. Shore A hardness of 25-30.
6. Structural glazing application.

H. S-8:

1. ASTM C920, silicone, acetoxycure.

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2. Type S.
3. Class 25.
4. Grade NS.
5. Shore A hardness of 25-30.
6. Structural glazing application.

I. S-9:

1. ASTM C920 silicone.
2. Type S.
3. Class 25.
4. Grade NS.
5. Shore A hardness of 25-30.
6. Non-yellowing, mildew resistant.

J. S-10:

1. ASTM C920, coal tar extended fuel resistance polyurethane.
2. Type M/S.
3. Class 25.
4. Grade P/NS.
5. Shore A hardness of 15-20.

K. S-11:

1. ASTM C920 polyurethane.
2. Type M/S.
3. Class 25.
4. Grade P/NS.
5. Shore A hardness of 35 to 50.

L. S-12:

1. ASTM C920, polyurethane.
2. Type M/S.
3. Class 25, joint movement range of plus or minus 50 percent.

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- 4. Grade P/NS.
- 5. Shore A hardness of 25 to 50.

**2.2 CAULKING COMPOUND:**

- A. C-1: ASTM C834, acrylic latex.
- B. C-2: One component acoustical caulking, non drying, non hardening, synthetic rubber.

**2.3 COLOR:**

- A. Sealants used with exposed masonry shall match color of mortar joints.
- B. Sealants used with unpainted concrete shall match color of adjacent concrete.
- C. Color of sealants for other locations shall be light gray or aluminum, unless specified otherwise.
- D. Caulking shall be light gray or white, unless specified otherwise.

**2.4 JOINT SEALANT BACKING:**

- A. General: Provide sealant backings of material and type that are nonstaining; are compatible with joint substrates, sealants, primers, and other joint fillers; and are approved for applications indicated by sealant manufacturer based on field experience and laboratory testing.
- B. Cylindrical Sealant Backings: ASTM C1330, of type indicated below and of size and density to control sealant depth and otherwise contribute to producing optimum sealant performance:
  - 1. Type C: Closed-cell material with a surface skin.
- C. Elastomeric Tubing Sealant Backings: Neoprene, butyl, EPDM, or silicone tubing complying with ASTM D1056, nonabsorbent to water and gas, and capable of remaining resilient at temperatures down to minus 32° C (minus 26° F). Provide products with low compression set and of size and shape to provide a secondary seal, to control sealant depth, and otherwise contribute to optimum sealant performance.
- D. Bond-Breaker Tape: Polyethylene tape or other plastic tape recommended by sealant manufacturer for preventing sealant from



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adhering to rigid, inflexible joint-filler materials or joint surfaces at back of joint where such adhesion would result in sealant failure. Provide self-adhesive tape where applicable.

**2.5 FILLER:**

- A. Mineral fiber board: ASTM C612, Class 1.
- B. Thickness same as joint width.
- C. Depth to fill void completely behind back-up rod.

**2.6 PRIMER:**

- A. As recommended by manufacturer of caulking or sealant material.
- B. Stain free type.

**2.7 CLEANERS-NON POUROUS SURFACES:**

- A. Chemical cleaners acceptable to manufacturer of sealants and sealant backing material, free of oily residues and other substances capable of staining or harming joint substrates and adjacent non-porous surfaces and formulated to promote adhesion of sealant and substrates.

**PART 3 - EXECUTION**

**3.1 INSPECTION:**

- A. Inspect substrate surface for bond breaker contamination and unsound materials at adherent faces of sealant.
- B. Coordinate for repair and resolution of unsound substrate materials.
- C. Inspect for uniform joint widths and that dimensions are within tolerance established by sealant manufacturer.

**3.2 PREPARATIONS:**

- A. Prepare joints in accordance with manufacturer's instructions and SWRI.

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- B. Clean surfaces of joint to receive caulking or sealants leaving joint dry to the touch, free from frost, moisture, grease, oil, wax, lacquer paint, or other foreign matter that would tend to destroy or impair adhesion.
  - 1. Clean porous joint substrate surfaces by brushing, grinding, blast cleaning, mechanical abrading, or a combination of these methods to produce a clean, sound substrate capable of developing optimum bond with joint sealants.
  - 2. Remove loose particles remaining from above cleaning operations by vacuuming or blowing out joints with oil-free compressed air. Porous joint surfaces include the following:
    - a. Concrete.
    - b. Masonry.
    - c. Unglazed surfaces of ceramic tile.
  - 3. Remove laitance and form-release agents from concrete.
  - 4. Clean nonporous surfaces with chemical cleaners or other means that do not stain, harm substrates, or leave residues capable of interfering with adhesion of joint sealants.
    - a. Metal.
    - b. Glass.
    - c. Porcelain enamel.
    - d. Glazed surfaces of ceramic tile.
- C. Do not cut or damage joint edges.
- D. Apply masking tape to face of surfaces adjacent to joints before applying primers, caulking, or sealing compounds.
  - 1. Do not leave gaps between ends of sealant backings.
  - 2. Do not stretch, twist, puncture, or tear sealant backings.
  - 3. Remove absorbent sealant backings that have become wet before sealant application and replace them with dry materials.
- E. Apply primer to sides of joints wherever required by compound manufacturer's printed instructions.
  - 1. Apply primer prior to installation of back-up rod or bond breaker

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tape.

2. Use brush or other approved means that will reach all parts of joints.

F. Take all necessary steps to prevent three sided adhesion of sealants.

**3.3 BACKING INSTALLATION:**

- A. Install back-up material, to form joints enclosed on three sides as required for specified depth of sealant.
- B. Where deep joints occur, install filler to fill space behind the back-up rod and position the rod at proper depth.
- C. Cut fillers installed by others to proper depth for installation of back-up rod and sealants.
- D. Install back-up rod, without puncturing the material, to a uniform depth, within plus or minus 3 mm (1/8 inch) for sealant depths specified.
- E. Where space for back-up rod does not exist, install bond breaker tape strip at bottom (or back) of joint so sealant bonds only to two opposing surfaces.
- F. Take all necessary steps to prevent three sided adhesion of sealants.

**3.4 SEALANT DEPTHS AND GEOMETRY:**

- A. At widths up to 6 mm (1/4 inch), sealant depth equal to width.
- B. At widths over 6 mm (1/4 inch), sealant depth 1/2 of width up to 13 mm (1/2 inch) maximum depth at center of joint with sealant thickness at center of joint approximately 1/2 of depth at adhesion surface.

**3.5 INSTALLATION:**

- A. General:
  1. Apply sealants and caulking only when ambient temperature is between
  2. 5° C and 38° C (40° and 100° F).
  3. Do not use polysulfide base sealants where sealant may be exposed to fumes from bituminous materials, or where water vapor in continuous contact with cementitious materials may be present.

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4. Do not use sealant type listed by manufacture as not suitable for use in locations specified.
  5. Apply caulking and sealing compound in accordance with manufacturer's printed instructions.
  6. Avoid dropping or smearing compound on adjacent surfaces.
  7. Fill joints solidly with compound and finish compound smooth.
  8. Tool joints to concave surface unless shown or specified otherwise.
  9. Finish paving or floor joints flush unless joint is otherwise detailed.
  10. Apply compounds with nozzle size to fit joint width.
  11. Test sealants for compatibility with each other and substrate. Use only compatible sealant.
- B. For application of sealants, follow requirements of ASTM C1193 unless specified otherwise.
- C. Where gypsum board partitions are of sound rated, fire rated, or smoke barrier construction, follow requirements of ASTM C919 only to seal all cut-outs and intersections with the adjoining construction unless specified otherwise.
1. Apply a 6 mm (1/4 inch) minimum bead of sealant each side of runners (tracks), including those used at partition intersections with dissimilar wall construction.
  2. Coordinate with application of gypsum board to install sealant immediately prior to application of gypsum board.
  3. Partition intersections: Seal edges of face layer of gypsum board abutting intersecting partitions, before taping and finishing or application of veneer plaster-joint reinforcing.
  4. Openings: Apply a 6 mm (1/4 inch) bead of sealant around all cut-outs to seal openings of electrical boxes, ducts, pipes and similar penetrations. To seal electrical boxes, seal sides and backs.
  5. Control Joints: Before control joints are installed, apply sealant in back of control joint to reduce flanking path for sound through control joint.

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**3.6 FIELD QUALITY CONTROL:**

- A. Field-Adhesion Testing: Field-test joint-sealant adhesion to joint substrates as recommended by sealant manufacturer:
  - 1. Extent of Testing: Test completed elastomeric sealant joints as follows:
    - a. Perform 10 tests for first 300 m (1000 feet) of joint length for each type of elastomeric sealant and joint substrate.
    - b. Perform one test for each 300 m (1000 feet) of joint length thereafter or one test per each floor per elevation.
- B. Inspect joints for complete fill, for absence of voids, and for joint configuration complying with specified requirements. Record results in a field adhesion test log.
- C. Inspect tested joints and report on following:
  - 1. Whether sealants in joints connected to pulled-out portion failed to adhere to joint substrates or tore cohesively. Include data on pull distance used to test each type of product and joint substrate.
  - 2. Compare these results to determine if adhesion passes sealant manufacturer's field-adhesion hand-pull test criteria.
  - 3. Whether sealants filled joint cavities and are free from voids.
  - 4. Whether sealant dimensions and configurations comply with specified requirements.
- D. Record test results in a field adhesion test log. Include dates when sealants were installed, names of persons who installed sealants, test dates, test locations, whether joints were primed, adhesion results and percent elongations, sealant fill, sealant configuration, and sealant dimensions.
- E. Repair sealants pulled from test area by applying new sealants following same procedures used to originally seal joints. Ensure that original sealant surfaces are clean and new sealant contacts original sealant.
- F. Evaluation of Field-Test Results: Sealants not evidencing adhesive failure from testing or noncompliance with other indicated requirements, will be considered satisfactory. Remove sealants that

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fail to adhere to joint substrates during testing or to comply with other requirements. Retest failed applications until test results prove sealants comply with indicated requirements.

**3.7 CLEANING:**

- A. Fresh compound accidentally smeared on adjoining surfaces: Scrape off immediately and rub clean with a solvent as recommended by the caulking or sealant manufacturer.
- B. After filling and finishing joints, remove masking tape.
- C. Leave adjacent surfaces in a clean and unstained condition.

**3.8 LOCATIONS:**

A. Exterior Building Joints, Horizontal and Vertical:

- 1. Metal to Metal: Type S-1, S-2
- 2. Metal to Masonry or Stone: Type S-1
- 3. Masonry to Masonry or Stone: Type S-1
- 4. Stone to Stone: Type S-1
- 5. Cast Stone to Cast Stone: Type S-1
- 6. Threshold Setting Bed: Type S-1, S-3, S-4
- 7. Masonry Expansion and Control Joints: Type S-6
- 8. Wood to Masonry: Type S-1

B. Metal Reglets and Flashings:

- 1. Flashings to Wall: Type S-6
- 2. Metal to Metal: Type S-6

C. Sanitary Joints:

- 1. Walls to Plumbing Fixtures: Type S-9
- 2. Counter Tops to Walls: Type S-9
- 3. Pipe Penetrations: Type S-9

D. Horizontal Traffic Joints:

- 1. Concrete Paving, Unit Pavers: Type S-11 or S-12
- 2. Garage/Parking Decks: Type S-10

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E. High Temperature Joints over 204 degrees C (400 degrees F):

1. Exhaust Pipes, Flues, Breech Stacks: Type S-7 or S-8

F. Interior Caulking:

1. Typical Narrow Joint 6 mm, (1/4 inch) or less at Walls and Adjacent Components: Types C-1 and C-2.
2. Perimeter of Doors, Windows, Access Panels which Adjoin Concrete or Masonry Surfaces: Types C-1 and C-2.
3. Joints at Masonry Walls and Columns, Piers, Concrete Walls or Exterior Walls: Types C-1 and C-2.
4. Perimeter of Lead Faced Control Windows and Plaster or Gypsum Wallboard Walls: Types C-1 and C-2.
5. Exposed Isolation Joints at Top of Full Height Walls: Types C-1 and C-2.
6. Exposed Acoustical Joint at Sound Rated Partitions Type C-2.
7. Concealed Acoustic Sealant Types S-4, C-1 and C-2.

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SECTION 08 11 13

HOLLOW METAL DOORS AND FRAMES

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

- A. This section specifies steel doors, steel frames and related components.
- B. Terms relating to steel doors and frames as defined in ANSI A123.1 and as specified.

**1.2 RELATED WORK**

- A. Doors and frames of a forced entry/ballistic resistant rated: Section 08 34 53, SECURITY DOORS AND FRAMES.
- B. Door Hardware: Section 08 71 00, DOOR HARDWARE.
- C. Glazing: Section 08 80 00, GLAZING.
- D. Card readers and biometric devices: Section 28 13 00, ACCESS CONTROL.

**1.3 TESTING**

- A. An independent testing laboratory shall perform testing.

**1.4 SUBMITTALS**

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Manufacturers Literature and Data:
  - 1. Fire rated doors and frames, showing conformance with NFPA 80 and Underwriters Laboratory, Inc., or Intertek Testing Services or Factory Mutual fire rating requirements and temperature rise rating for stairwell doors. Submit proof of temperature rating.
  - 2. Sound rated doors, including test report from Testing Laboratory.

**1.5 SHIPMENT**

- A. Prior to shipment label each door and frame to show location, size, door swing and other pertinent information.

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- B. Fasten temporary steel spreaders across the bottom of each door frame.

**1.6 STORAGE AND HANDLING**

- A. Store doors and frames at the site under cover.
- B. Protect from rust and damage during storage and erection until completion.

**1.7 APPLICABLE PUBLICATIONS**

- A. Publications listed below form a part of this specification to the extent referenced. Publications are referenced in the text by the basic designation only.

- B. Door and Hardware Institute (DHI):

- 1. A115 Series Steel Door and Frame Preparation for Hardware, Series A115.1 through A115.17 (Dates Vary)

- C. Steel Door Institute (SDI):

- 1. 113-01 Thermal Transmittance of Steel Door and Frame Assemblies
  - 2. 128-1997 Acoustical Performance for Steel Door and Frame Assemblies
  - 3. A250.8-03 Standard Steel Doors and Frames

- D. American Society for Testing and Materials (ASTM):

- 1. A568/568-M-07 Steel, Sheet, Carbon, and High-Strength, Low-alloy, Hot-Rolled and Cold-Rolled
  - 2. A1008-08 Steel, sheet, Cold-Rolled, Carbon, Structural, High Strength Low Alloy and High Strength Low Alloy with Improved Formability
  - 3. D1621-04 Compressive Properties of Rigid Cellular Plastics
  - 4. E90-04 Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions

- E. The National Association Architectural Metal Manufacturers (NAAMM):

- 1. Metal Finishes Manual (1988 Edition)

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F. National Fire Protection Association (NFPA):

1. 80-09 Fire Doors and Fire Windows

G. Underwriters Laboratories, Inc. (UL):

1. Fire Resistance Directory

H. Intertek Testing Services (ITS):

1. Certifications Listings...Latest Edition

I. Factory Mutual System (FM):

1. Approval Guide

**PART 2 - PRODUCTS**

**2.1 MATERIALS**

- A. Sheet Steel: ASTM A1008, cold-rolled for panels (face sheets) of doors.
- B. Anchors, Fastenings and Accessories: Fastenings anchors, clips connecting members and sleeves from zinc coated steel.
- C. Prime Paint: Paint that meets or exceeds the requirements of A250.8.

**2.2 FABRICATION, GENERAL**

A. GENERAL:

1. Follow SDI A250.8 for fabrication of standard steel doors, except as specified otherwise. Doors to receive hardware specified in Section 08 71 00, DOOR HARDWARE. Tolerances as per SDI A250.8. Thickness, 44 mm (1-3/4 inches), unless otherwise shown.
2. When vertical steel stiffeners are used for core construction, fill spaces between stiffeners with mineral fiber insulation.

- B. Standard Duty Doors: SDI A250.8, Level 1, Model 2 of size and design shown. Use for interior locations only. Do not use for stairwell doors, security doors and detention doors.

- C. Heavy Duty Doors: SDI A250.8, Level 2, Model 2 of size and design shown. Core construction types a, d, or f, for interior doors.

D. Smoke Doors:

1. Close top and vertical edges flush.

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2. Provide seamless vertical edges.
3. Apply Steel astragal to the meeting stile at the active leaf of pair of doors or double egress doors.
4. Provide clearance at head, jamb and sill as specified in NFPA 80.

**E. Fire Rated Doors (Labeled):**

1. Conform to NFPA 80 when tested by Underwriters Laboratories, Inc., Inchcape Testing Services, or Factory Mutual for the class of door or door opening shown.
2. Fire rated labels of metal, with raised or incised markings of approving laboratory shall be permanently attached to doors.
3. Close top and vertical edges of doors flush. Vertical edges shall be seamless. Apply steel astragal to the meeting stile of the active leaf of pairs of fire rated doors, except where vertical rod exit devices are specified for both leaves swinging in the same direction.
4. Construct fire rated doors in stairwell enclosures for maximum transmitted temperature rise of 230° C (450° F) above ambient temperature at end of 30 minutes of fire exposure when tested in accordance with ASTM E152.

**F. Custom Metal Hollow Doors:**

1. Provide custom hollow metal doors where nonstandard steel doors are indicated. At the Contractor's option, custom hollow metal doors may be provided in lieu of standard steel doors. Door size(s), design, materials, construction, gages and finish shall be as specified for standard steel doors.

**G. Sound Rated Doors:**

1. SDI 114, except as specified otherwise.
2. Sound Transmission Class minimum of 45 when tested in accordance with ASTM E90.
3. Doors complete with integral spring type automatic door bottom seal and with integral continuous gaskets on the frames. Applied spring type automatic door bottom seal and applied continuous gaskets for the frames for doors that are not sound rated but sealed for

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flanking noises are specified in Section 08 71 00, DOOR HARDWARE.

4. Fabricate vision panels to receive double glazing where shown.

**2.3 METAL FRAMES**

**A. General:**

1. SDI A250.8, 1.3 mm (0.053 inch) thick sheet steel, types and styles as shown or scheduled.
2. Frames for labeled fire rated doors.
  - a. Comply with NFPA 80. Test by Underwriters Laboratories, Inc., Inchcape Testing Services, or Factory Mutual.
  - b. Fire rated labels of approving laboratory permanently attached to frames as evidence of conformance with these requirements. Provide labels of metal or engraved stamp, with raised or incised markings.
3. Frames for doors specified to have automatic door operators; Security doors (Type 36); service window: minimum 1.7 mm (0.067 inch) thick.
4. Knocked-down frames are not acceptable.

**B. Reinforcement and Covers:**

1. SDI A250.8 for, minimum thickness of steel reinforcement welded to back of frames.
2. Provide mortar guards securely fastened to back of hardware reinforcements except on lead-lined frames.
3. Where concealed door closers are installed within the head of the door frames, prepare frames for closers and provide 1 mm (0.042 inch) thick steel removable stop sections for access to concealed face plates and control valves, except when cover plates are furnished with closer.

**C. Terminated Stops: SDI A250.8.**

**D. Glazed Openings:**

1. Integral stop on corridor or secure side of door.
2. Design rabbet width and depth to receive glazing material or panel shown or specified.

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E. Frame Anchors:

1. Floor anchors:

- a. Where floor fills occur, provide extension type floor anchors to compensate for depth of fill.
- b. At bottom of jamb use 1.3 mm (0.053 inch) thick steel clip angles welded to jamb and drilled to receive two 6 mm (1/4 inch) floor bolts. Use 50 mm x 50 mm (2 inch by 2 inch) 9 mm (3/8 inch) clip angle for lead lined frames, drilled for 9 mm (3/8 inch) floor bolts.
- c. Where mullions occur, provide 2.3 mm (0.093 inch) thick steel channel anchors, drilled for two 6 mm (1/4 inch) floor bolts and frame anchor screws.
- d. Where sill sections occur, provide continuous 1 mm (0.042 inch) thick steel rough bucks drilled for 6 mm (1/4 inch) floor bolts and frame anchor screws. Space floor bolts at 50 mm (24 inches) on center.

2. Jamb anchors:

- a. Locate anchors on jambs near top and bottom of each frame, and at intermediate points not over 600 mm (24 inches) apart, except for fire rated frames space anchors as required by labeling authority.
- b. Form jamb anchors of not less than 1 mm (0.042 inch) thick steel unless otherwise specified.
- c. Anchors set in masonry: Use adjustable anchors designed for friction fit against the frame and for extension into the masonry not less than 250 mm (10 inches). Use one of following type:
  - 1) Wire loop type of 5 mm (3/16 inch) diameter wire.
  - 2) T-shape or strap and stirrup type of corrugated or perforated sheet steel.
- d. Anchors for stud partitions: Either weld to frame or use lock-in snap-in type. Provide tabs for securing anchor to the sides of the studs.

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e. Anchors for frames set in prepared openings:

- 1) Steel pipe spacers with 6 mm (1/4 inch) inside diameter welded to plate reinforcing at jamb stops or hat shaped formed strap spacers, 50 mm (2 inches) wide, welded to jamb near stop.
- 2) Drill jamb stop and strap spacers for 6 mm (1/4 inch) flat head bolts to pass thru frame and spacers.
- 3) Two piece frames: Subframe or rough buck drilled for 6 mm (1/4 inch) bolts.

f. Anchors for observation windows and other continuous frames set in stud partitions.

- 1) In addition to jamb anchors, weld clip anchors to sills and heads of continuous frames over 1200 mm (4 feet) long.
- 2) Anchors spaced 600 mm (24 inches) on centers maximum.

g. Modify frame anchors to fit special frame and wall construction and provide special anchors where shown or required.

**PART 3 - EXECUTION**

**3.1 INSTALLATION**

A. Plumb, align and brace frames securely until permanent anchors are set.

1. Use triangular bracing near each corner on both sides of frames with temporary wood spreaders at midpoint.
2. Use wood spreaders at bottom of frame if the shipping spreader is removed.
3. Protect frame from accidental abuse.
4. Where construction will permit concealment, leave the shipping spreaders in place after installation, otherwise remove the spreaders after the frames are set and anchored.
5. Remove wood spreaders and braces only after the walls are built and jamb anchors are secured.

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**B. Floor Anchors:**

1. Anchor the bottom of door frames to floor with two 6 mm (1/4 inch) diameter expansion bolts.

**C. Jamb Anchors:**

1. Anchors in masonry walls: Embed anchors in mortar. Fill space between frame and masonry wall with grout or mortar as walls are built.
2. Coat frame back with a bituminous coating prior to lining of grout filling in masonry walls.
3. Secure anchors to sides of studs with two fasteners through anchor tabs. Use steel drill screws to steel studs.
4. Frames set in prepared openings of masonry or concrete: Expansion bolt to wall with 6 mm (1/4 inch) expansion bolts through spacers. Where subframes or rough bucks are used, 6 mm (1/4 inch) expansion bolts on 600 mm (24 inch) centers. Secure two piece frames to subframe or rough buck with machine screws on both faces.

**D. Install anchors for labeled fire rated doors to provide rating as required.**

**E. Frames for Sound Rated Doors: Coordinate to line frames for sound rated doors with insulation.**

**F. Overhead Bracing (Lead Lined Frames):** Where jamb extensions extend to structure above, anchor clip angles with not less than two, 9 mm (3/8 inch) expansion bolts or power actuated drive pins to concrete slab. Weld to steel overhead members.

**3.2 INSTALLATION OF DOORS AND APPLICATION OF HARDWARE**

- A. Install doors and hardware as specified in Section 08 11 13, HOLLOW METAL DOORS AND FRAMES; Section 08 14 00, INTERIOR WOOD DOORS; and Section 08 71 00, DOOR HARDWARE .

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SECTION 08 11 16  
ALUMINUM DOORS AND FRAMES

**PART 1 - GENERAL**

**1.1 DESCRIPTION:**

This section covers aluminum sliding/barn doors.

**1.2 SUBMITTALS:**

- A. In accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES, furnish following:
- B. Shop Drawings: Showing details of construction and installation details.
- C. Manufacturer's Literature and Data: Indicating door type specified and installation instructions.

**PART 2 - PRODUCTS**

**2.1 ALUMINUM SLIDING/BARN DOORS:**

- A. Doors Manufacturer's standard reversible / non-handed barn door unit that travels on single continuous track which mounted as shown on Drawings without damage to wall system header and frames and allowing reconfiguration without part replacement. Provide ADA compliant configuration and operation in both clear opening and opening force per section 4.13 of ADA Guidelines.

- 1. Description: Door unit includes self-supporting header and track, jambs, and sliding door, completely trackless at floor between jambs.

- a. Door Thickness: 43 mm (1-11/16 inches) thick.

- b. Glazing: Tempered glass, thickness as indicated on Drawings.

- c. Hardware: Manufacturer's standard sliding door hardware with pulls.

- (1) Provide complete set of replacement hardware for each door as "attic stock."

- 3. Door Panel Construction: Includes means to ensure against racking failure. Provide door style indicated on Drawings.

- 4. Operation: In addition to integral overhead stops, provide integral adjustable deceleration mechanism to reduce travel velocity to near

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zero as door approaches its open and closed limit to prevent door slamming at either limit.

5. Frame Finish: Manufacturer's powder coat; color as indicated in Finish Schedule.

B. Frames: Manufacturer's standard aluminum frame, single continuous track mounted to wall system and capable of reconfiguration without part replacement or damage to wall components.

1. Configuration: Self-supporting header and track, jambs, sliding door, and trackless at floor between jambs in dimensions shown on Drawings.

a. Extrusion Profile: As shown on Drawings.

2. Frame Height: Jambs provided over length by 50 mm (2 inches) in height, for field cutting to suit opening height for proper alignment with adjacent frames. Provide factory notching and drilling in jambs for ceiling track and manufacturer's standard header attachment.

2. Frame and Track Construction: Continuous extruded self-supporting header section concealing track mechanism with concealed guides to stabilize bottom of door. Strike side of door secures door in closed position. Full length of door travel has anti-derailing mechanism. Continuous flexible seal provided on guide and strike side of barn door frame for complete light and sound seal when door in closed position.

**PART 3 - EXECUTION**

**3.1 INSTALLATION:**

A. Installation shall be by experienced mechanics capable of installing the doors in accordance with the shop drawings and manufacturer's instructions.

B. Set work accurately, in alignment and where shown. Items shall be plumb, level, free of rack and twist, and set parallel or perpendicular as required to line and plane of surface.

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**3.2 CLEANING AND ADJUSTING:**

All movable parts including hardware shall be cleaned and adjusted to operate as designed without binding or deformation of the members, and to fit tight and even without forcing or warping the components.

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SECTION 08 14 00

INTERIOR WOOD DOORS

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This section specifies interior flush doors with prefinish, prefit option.
- B. Section includes fire rated doors, sound retardant doors, and rated smoke doors.

1.2 RELATED WORK

- A. Metal door frames: Section 08 11 13, HOLLOW METAL DOORS AND FRAMES.
- B. Door hardware including hardware location (height): Section 08 71 00, DOOR HARDWARE.
- C. Installation of doors and hardware: Section 08 11 13, HOLLOW METAL DOORS AND FRAMES, Section **081400**, WOOD DOORS, or Section 08 71 00, DOOR HARDWARE.
- D. Glazing: Section 08 80 00, GLAZING.
- E. Finish: Finish Schedule.
- F. Card readers and biometric devices: Section 28 13 00, ACCESS CONTROL

1.3 SUBMITTALS

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Samples:
  - 1. Corner section of flush veneered door 300 mm (12 inches) square, showing details of construction, labeled to show grade and type number and conformance to specified standard.
  - 2. Veneer sample 200 mm (8 inch) by 275 mm (11 inch) by 6 mm (1/4 inch) showing specified wood species sanded to receive a transparent finish. Factory finish veneer sample where the prefinished option is accepted.

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**C. Shop Drawings:**

1. Show every door in project and schedule location in building.
2. Indicate type, grade, finish and size; include detail of glazing, sound gasketing, and pertinent details.
3. Provide information concerning specific requirements not included in the manufacturer's literature and data submittal.

**D. Manufacturer's Literature and Data:**

1. Sound rated doors, including test report indicating STC rating per ASTM E90 from test laboratory.
2. Labeled fire rated doors showing conformance with NFPA 80.

**1.4 WARRANTY**

A. Doors are subject to terms of Article titled "Warranty of Construction", FAR clause 52.246-21, except that warranty shall be as follows:

1. For interior doors, manufacturer's warranty for lifetime of original installation.
2. Specified STC RATING for sound retardant rated door assembly in place.

**1.5 DELIVERY AND STORAGE**

- A. Factory seal doors and accessories in cardboard packages which shall remain unbroken during delivery and storage.
- B. Store in accordance with WDMA I.S.1-A, J-1 Job Site Information.
- C. Label package for door opening where used.

**1.6 APPLICABLE PUBLICATIONS**

- A. Publications listed below form a part of this specification to extent referenced. Publications are referenced in text by basic designation only.
- B. Window and Door Manufacturers Association (WDMA):
1. I.S.1-A-04      Architectural Wood Flush Doors
  2. I.S.6A-01      Architectural Wood Stile and Rail Doors

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3. T.M.5-90 Split Resistance Test Method
4. T.M.6-08 Adhesive (Glue Bond) Durability Test Method
5. T.M.7-08 Cycle-Slam Test Method
6. T.M.8-08 Hinge Loading Test Method
7. T.M.10-08 Screwholding Test Method
- C. National Fire Protection Association (NFPA):
  1. 80-07 Protection of Buildings from Exterior Fire
  2. 252-08 Fire Tests of Door Assemblies
- D. ASTM International (ASTM):
  1. E90-04 Laboratory Measurements of Airborne Sound Transmission Loss

**PART 2 - PRODUCTS**

**2.1 FLUSH DOORS**

- A. General:
  1. Meet requirements of WDMA I.S.1-A, Extra Heavy Duty.
  2. Adhesive: Type II, low VOC or no VOC.
  3. Thickness: 45 mm (1-3/4 inches) unless otherwise shown or specified.
- B. Face Veneer:
  1. In accordance with WDMA I.S.1-A.
  2. One species throughout the project unless scheduled or otherwise shown.
  3. For transparent finishes: Premium Grade. Quarter sliced, white Birch.
    - a. A grade face veneer standard optional.
    - b. AA grade face veneer
    - c. Match face veneers for doors for uniform effect of color and grain at joints.
    - d. Door edges shall be same species as door face veneer except maple

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may be used for stile face veneer on birch doors.

e. On doors required to have transparent finish on one side and paint finish on other side; use veneers as required for transparent finish on both sides.

f. In existing buildings, where doors are required to have transparent finish, use wood species and grade of face veneers to match adjacent existing doors.

4. Factory sand doors for finishing.

C. Wood for stops, muntins and moldings of flush doors required to have transparent finish:

1. Solid Wood of same species as face veneer, except maple may be used on birch doors.

2. Glazing:

a. On non-labeled doors use applied wood stops nailed tight on room side and attached on opposite side with flathead, countersunk wood screws, spaced approximately 125 mm (5 inches) on centers.

D. Stiles and Rails:

1. Option for wood stiles and rails:

a. Composite material having screw withdrawal force greater than minimum performance level value when tested in accordance with WDMA T.M.10.

2. Provide adequate blocking for bottom of doors having mechanically operated door bottom seal meeting or exceeding the performance duty level per T.M.10 for horizontal door edge screw holding.

E. Fire rated wood doors:

1. Fire Performance Rating:

a. "B" label, 1-1/2 hours.

b. "C" label, 3/4 hour.

2. Labels:

a. Doors shall conform to the requirements of ASTM E2074, or NFPA 252, and, carry a factory-applied identifying label from a qualified testing and inspection agency for class of door or



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opening shown designating fire performance rating.

b. Metal labels with raised or incised markings.

3. Performance Criteria for Stiles of doors utilizing standard mortise leaf hinges:

a. Hinge Loading: WDMA T.M.8. Average of 10 test samples for Extra Heavy Duty doors.

b. Direct screw withdrawal: WDMA T.M.10 for Extra Heavy Duty doors. Average of 10 test samples using a steel, fully threaded #12 wood screw.

c. Cycle Slam: 1,000,000 cycles with no loose hinge screws or other visible signs of failure when tested in accordance with WDMA T.M.7.

4. Additional Hardware Reinforcement:

a. Provide fire rated doors with hardware reinforcement blocking.

b. Size of lock blocks as required to secure hardware specified.

c. Top, bottom and intermediate rail blocks shall measure not less than 125 mm (five inches) minimum by full core width.

d. Reinforcement blocking in compliance with manufacturer's labeling requirements.

e. Mineral material similar to core is not acceptable.

5. Other Core Components: Manufacturer's standard as allowed by the labeling requirements.

6. Provide steel frame approved for use in labeled doors for vision panels.

7. Provide steel astragal on pair of doors.

F. Smoke Barrier Doors:

1. For glazed openings use steel frames approved for use in labeled doors.

2. Provide a steel astragal on one leaf of pairs of doors, including double egress doors.

3. Provide door closer coordinator for all pairs of doors, unless otherwise indicated.

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**G. Sound Rated Doors:**

1. Fabricated as specified for flush wood doors with additional construction requirements to meet specified sound transmission class (STC).
2. STC Rating of the door assembly in place when tested in accordance with ASTM E90 by an independent nationally recognized acoustical testing laboratory not less than 45.
3. Accessories:
  - a. Frame Gaskets: Continuous closed cell neoprene metal mounted removable in extruded aluminum housing with a medium matte 0.1 mm (4.0 mil) thick clear Anodized finish.
  - b. Automatic Door Bottom Seal:
    - 1) Concealed or Surface Mounted.

**2.2 PREFINISH, PREFIT OPTION**

- A. Flush doors may be factory machined to receive hardware, bevels, undercuts, cutouts, accessories and fitting for frame.
- B. Factory fitting to conform to specification for shop and field fitting, including factory application of sealer to edge and routings.
- C. Flush doors to receive transparent finish (in addition to being prefit )shall be factory finished as follows:
  1. WDMA I.S.1-A Section F-3 specification for System TR-4, Conversion Varnish or System TR-5, Catalyzed Vinyl.
  2. Use stain when required to produce the finish specified in Finish Schedule.

**2.3 IDENTIFICATION MARK:**

- A. On top edge of door.
- B. Either a stamp, brand or other indelible mark, giving manufacturer's name, door's trade name, construction of door, code date of manufacture and quality.

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C. Accompanied by either of the following additional requirements:

1. An identification mark or a separate certification including name of inspection organization.
2. Identification of standards for door, including glue type.
3. Identification of veneer and quality certification.
4. Identification of preservative treatment for stile and rail doors.

**2.4 SEALING:**

- A. Give top and bottom edge of doors two coats of catalyzed polyurethane or water resistant sealer before sealing in shipping containers.

**PART 3 - EXECUTION**

**3.1 DOOR PREPARATION**

- A. Field, shop or factory preparation: Do not violate the qualified testing and inspection agency label requirements for fire rated doors.
- B. Clearances between Doors and Frames and Floors:
1. Maximum 3 mm (1/8 inch) clearance at the jambs, heads, and meeting stiles, and a 12 mm (1/2 inch) clearance at bottom, except as otherwise specified.
  2. Maximum clearance at bottom of sound rated doors, light-proofed doors, doors to operating rooms, and doors designated to be fitted with mechanical seal: 10 mm (3/8 inch).
- C. Provide cutouts for special details required and specified.
- D. Rout doors for hardware using templates and location heights specified in Section, 08 71 00 DOOR HARDWARE.
- E. Fit doors to frame, bevel lock edge of doors 3 mm (1/8 inch) for each 50 mm (2 inches) of door thickness undercut where shown.
- F. Immediately after fitting and cutting of doors for hardware, seal cut edges of doors with two coats of water resistant sealer.
- G. Finish surfaces, including both faces, top and bottom and edges of the doors smooth to touch.
- H. Apply a steel astragal on the opposite side of active door on pairs

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of fire rated doors.

- I. Apply a steel astragal to meeting style of active leaf of pair of doors or double egress smoke doors.

**3.2 INSTALLATION OF DOORS APPLICATION OF HARDWARE**

- A. Install doors and hardware as specified in this Section.

**3.3 DOOR PROTECTION**

- A. As door installation is completed, place cardboard shipping container over door and tape in place.
- B. Provide protective covering over knobs and handles in addition to covering door.
- C. Maintain covering in good condition until removal is approved by Resident Engineer.

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SECTION 08 31 13

ACCESS DOORS AND FRAMES

PART 1 - GENERAL

1.1 DESCRIPTION:

- A. Section specifies access doors or panels.

1.2 RELATED WORK:

- A. Lock Cylinders: Section 08 71 00, DOOR HARDWARE.
- B. Locations of access doors for duct work cleanouts: Section 23 31 00, HVAC DUCTS AND CASINGS Section 23 37 00, AIR OUTLETS AND INLETS.

1.3 SUBMITTALS:

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Shop Drawings: Access doors, each type, showing construction, location and installation details.
- C. Manufacturer's Literature and Data: Access doors, each type.

1.4 APPLICABLE PUBLICATIONS

- A. Publications listed below form a part of this specification to extent referenced. Publications are referenced in the text by basic designation only.
- B. American Society for Testing and Materials (ASTM):
  - 1. A167-99(R-2009) Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet and Strip
  - 2. A1008-10 Steel Sheet, Cold-Rolled, Carbon, Structural, High Strength Low-Alloy
- C. American Welding Society (AWS):
  - 1. D1.3-08 Structural Welding Code Sheet Steel
- D. National Fire Protection Association (NFPA):
  - 1. 80-10 Fire Doors and Windows

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E. The National Association of Architectural Metal Manufacturers  
(NAAMM):

1. AMP 500 Series Metal Finishes Manual

F. Underwriters Laboratories, Inc. (UL):

1. Fire Resistance Directory

**PART 2 - PRODUCTS**

**2.1 FABRICATION, GENERAL**

A. Fabricate components to be straight, square, flat and in same plane where required.

1. Slightly round exposed edges and without burrs, snags and sharp edges.

2. Exposed welds continuous and ground smooth.

3. Weld in accordance with AWS D1.3.

B. Number of locks and non-continuous hinges as required to maintain alignment of panel with frame. For fire rated doors, use hinges and locks as required by fire test.

C. Provide anchors or make provisions in frame for anchoring to adjacent construction. Provide size, number and location of anchors on four sides to secure access door in opening. Provide anchors as required by fire test.

**2.2 ACCESS DOORS, FIRE RATED:**

A. Shall meet requirements for "B" label 1-1/2 hours with maximum temperature rise of 120 degree C (250 degrees F).

B. Comply with NFPA 80 and have Underwriters Laboratories Inc., or other nationally recognized laboratory label for Class B opening.

C. Door Panel: Form of 0.9 mm (0.0359 inch) thick steel sheet, insulated sandwich type construction.

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D. Frame: Form of 1.5 mm (0.0598 inch) thick steel sheet of depth and configuration to suit material and type of construction where installed. Provide frame flange at perimeter where installed in concrete masonry or gypsum board openings.

1. Weld exposed joints in flange and grind smooth.
2. Provide frame flange at perimeter where installed in concrete masonry or gypsum board.
3. Provide expanded galvanized metal lath perimeter wings when installed in plaster except veneer plaster.

E. Automatic Closing Device: Provide automatic closing device for door.

F. Hinge: Continuous steel hinge with stainless steel pin.

G. Lock:

1. Self-latching, with provision for fitting flush a standard screw-in type lock cylinder. Lock cylinder specified in Section 08 71 00, DOOR HARDWARE.
2. Provide latch release device operable from inside of door. Mortise case in door.

**2.3 ACCESS DOORS, FLUSH PANEL:**

A. Door Panel:

1. Form of 1.9 mm (0.0747 inch) thick steel sheet.
2. Reinforce to maintain flat surface.

B. Frame:

1. Form of 1.5 mm (0.0598 inch) thick steel sheet of depth and configuration to suit material and type of construction where installed.
2. Provide surface mounted units having frame flange at perimeter where installed in concrete, masonry, or gypsum board construction.
3. Weld exposed joints in flange and grind smooth.
4. Provide expanded galvanized metal lath perimeter wings when installed in plaster except veneer plaster.

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C. Hinge:

1. Concealed spring hinge to allow panel to open 175 degrees.
2. Provide removable hinge pin to allow removal of panel from frame.

D. Lock:

1. Flush, screwdriver operated cam lock.
2. Provide tamper proof screws (spanner head locks) for access panels in Psychiatric Areas.

**2.4 ACCESS DOOR, RECESSED PANEL:**

A. Door Panel:

1. Form of 1.2 mm (0.0478 inch) thick steel sheet to form a 25 mm (one inch) deep recessed pan to accommodate the installation of acoustical units or other materials where shown in walls and ceiling.
2. Reinforce as required to prevent sagging.

B. Frame:

1. Form of 1.5 mm (0.0598 inch) thick steel sheet of depth and configuration to suit installation in suspension system of ceiling or wall framing.
2. Extend sides of frame to protect edge of acoustical units when panel is in open position.
3. Provide shims, bushings, clips and other devices necessary for installation.

C. Hinge: Continuous steel hinge with stainless steel pin or concealed hinge.

D. Lock:

1. Flush screwdriver operated cam lock.
2. Provide sleeve of plastic or stainless steel grommet to protect hole made in acoustical unit for screwdriver access to lock.
3. Provide tamper proof screws (spanner head locks) for access panels in Psychiatric Areas.



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**2.5 ACCESS DOOR, GLASS FIBER REINFORCED GYPSUM (GFRG)**

A. Ceiling Doors: Glass fiber reinforced gypsum panels designed to blend seamlessly into gypsum board ceilings; consisting of surround frame with pre-spotted fastener holes and drop-in door. Includes tapered edge for tape joint and smooth round edge.

1. Flame Spread (ASTM E84-80): 0.

2. Smoke Index (ASTM E84-80): 0.

**2.6 FINISH:**

A. Provide in accordance with NAAMM AMP 500 series on exposed surfaces.

B. Steel Surfaces: Baked-on prime coat over a protective phosphate coating.

**2.7 SIZE:**

A. Minimum 600 mm (24 inches) square door unless otherwise shown [or required to suit opening in suspension system of ceiling.]

**PART 3 - EXECUTION**

**3.1 LOCATION:**

A. Provide access panels or doors wherever any valves, traps, dampers, cleanouts, and other control items of mechanical, electrical and conveyor work are concealed in wall or partition, or are above ceiling of gypsum board or plaster.

B. Use fire rated doors in fire rated partitions and ceilings.

C. Use flush panels in partitions and gypsum board or plaster ceilings, except lay-in acoustical panel ceilings or upward access acoustical tile ceilings.

D. Use recessed panel access doors in the following rooms [or spaces].

**3.2 INSTALLATION, GENERAL:**

A. Install access doors in openings to have sides vertical in wall installations, and parallel to ceiling suspension grid or side walls when installed in ceiling.

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- B. Set frames so that edge of frames without flanges will finish flush with surrounding finish surfaces.
- C. Set frames with flanges to overlap opening and so that face will be uniformly spaced from the finish surface.
- D. Set recessed panel access doors recessed so that face of surrounding materials will finish on the same plane, when finish in door is installed.

**3.3 ANCHORAGE:**

- A. Secure frames to adjacent construction using anchors attached to frames or by use of bolts or screws through the frame members.
- B. Type, size and number of anchoring device suitable for the material surrounding the opening, maintain alignment, and resist displacement during normal use of access door.
- C. Anchors for fire rated access doors shall meet requirements of applicable fire test.

**3.4 ADJUSTMENT:**

- A. Adjust hardware so that door panel will open freely.
- B. Adjust door when closed so door panel is centered in the frame.

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SECTION 08 33 00

COILING DOORS AND GRILLES

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This section specifies coiling grilles of sizes shown, complete as specified.

1.2 RELATED WORK

- A. Lock cylinders for cylindrical locks: Section 08 71 00, DOOR HARDWARE.
- B. Field painting: Section 09 91 00, PAINTING.
- C. Electric devices and wiring: DIVISION 26, ELECTRICAL.

1.3 MANUFACTURER'S AND INSTALLER'S QUALIFICATIONS

- A. Coiling grilles shall be products of manufacturers regularly engaged in manufacturing items of type specified.
- B. Install items under direct supervision of manufacturer's representative or trained personnel.

1.4 SUBMITTALS

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Shop Drawings:
  - 1. Each type of grille showing details of construction, accessories and hardware, electrical and mechanical items supporting brackets for motors, location, and ratings of motors, and safety devices.
  - 2. Wiring diagrams for motors and controls, including wiring diagram for grille , showing electrical interlock of motor with manually operated dead lock, electrical rough-in.
- C. Manufacturer's Literature and Data:
  - 1. Brochures or catalog cuts, each type door or grille.
  - 2. Manufacturer's installation procedures and instructions.
  - 3. Maintenance instructions, parts lists.

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**1.5 APPLICABLE PUBLICATIONS**

A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.

B. American Society for Testing and Materials (ASTM):

1. A36/A36M-08 Structural Steel
2. A167-99(R2009) Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet and Strip
3. A653/A653M-10 Steel Sheet, Zinc-Coated (Galvanized) Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
4. B209/209M-07 Aluminum and Aluminum-Alloy Sheet and Plate
5. B221/B221M-08 Aluminum-Alloy Extruded Bars, Rods, Wire, Shapes, and Tubes

C. National Electrical Manufacturers Association (NEMA):

1. ICS 1-00(R2008) Industrial Control and Systems General Requirements
2. ICS 2-00(R2005) Industrial Control, and Systems, Controllers, Contactors, and Overload Relays
3. ICS 6-93 (R2006) Industrial Control and Systems Enclosures
4. MG 1-10 Motors and Generators
5. ST 20-92 (R1997) Dry-Type Transformers for General Applications

D. Master Painters Institute (MPI):

1. MPI #35 Exterior Bituminous Coating
2. MPI #76 Quick Drying Alkyd Metal Primer

E. National Fire Protection Association (NFPA):

1. 70-11 National Electrical Code 1999 Edition
2. 80-10 Fire Doors and Fire Windows

F. National Association of Architectural Metal Manufacturers (NAAMM):

1. AMP 500 Series Metal Finishes Manual

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G. Underwriters Laboratories, Inc. (UL):

1. 2010 Fire Resistance Directory

**PART 2 - PRODUCTS**

**2.1 MATERIAL**

- A. Steel: A653 for forming operation. ASTM A36 for structural sections.
- B. Aluminum, Plate and Sheet: ASTM B209/B209M
- C. Aluminum, Extruded: ASTM B221/B221M

**2.2 DESIGN REQUIREMENTS**

- A. Coiling grilles shall be spring counter balanced, overhead coiling type, inside face mounted with guides at jambs set back a sufficient distance to provide a clear opening when door is in open position.
- B. All motor operators shall have manual emergency mechanical operators.

**2.3 FABRICATION**

A. Grilles:

1. Form of aluminum.
2. Horizontal rods, 8 mm (5/16 inch) minimum diameter spaced not over 50 mm (two inches) on center with hinged vertical connecting links. Links shall be spaced not over 225 mm (nine inches) apart.
3. Provide tubular bottom rail at bottom end of grille.
4. Two inch by 3-1/2 inch heavy duty extruded aluminum tubular section housing locking mechanism; mill finish.

B. Barrel and Spring Counterbalance:

1. Curtain shall coil on a barrel supported at end of opening on brackets and be balanced by helical springs.
2. Barrel fabricated of steel pipe or commercial welded steel tubing of proper diameter and thickness for the size of curtain, to limit deflection with curtain rolled up, not to exceed 1 in 400 (0.03 inch per foot) of span.
3. Close ends of barrel with cast iron plugs, machined to fit the opening.

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4. Within the barrel, install an oil-tempered, helical, counter balancing steel spring, capable of producing sufficient torque to assure easy operation of the door curtain from any position.
5. At least 80 percent of the door weight shall be counter balanced at any position.
6. Spring-tension shall be adjustable from outside of bracket without removing the hood or motor operator.

**C. Brackets:**

1. Steel plate designed to form end closure and support for hood and the end of the barrel assembly.
2. End of barrel or shaft shall screw into bracket hubs fabricated of cast iron or steel.
3. Equip bracket hubs or barrel plugs with prelubricated ball bearings, shielded or sealed.

**D. Hoods:**

1. Aluminum, not less than 1 mm (0.040 inch) thick.
2. Form hood to fit contour of end brackets.
3. Reinforce at top and bottom edges with rolled beads, rods or angles. Hoods more than 3600 mm (12 feet) in length shall have intermediate supporting brackets.
4. Fasten to brackets with screws or bolts and provide for attachment to wall with bolts.

**E. Guides:**

1. Manufacturer's standard formed sections or angles of aluminum.
  - a. Aluminum sections not less than 5 mm (0.1875 inch) thick.
2. Form a channel pocket of sufficient depth to retain the curtain in place under the horizontal pressure specified, and prevent ends of curtain from slipping out of guide slots.
3. Top sections flared for smooth entry of curtain to vertical sections that will facilitate entry of curtain.
4. Provide stops to limit curtain travel above top of guides.

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5. Provide guide of aluminum with replaceable wear strips to prevent metal to metal contact.

6. Mounting brackets shall provide closure between guides and jambs.

**F. Locking:**

1. Cylinder locks shall receive standard screw in cylinders furnished under Section, 08 71 00 DOOR HARDWARE.

2. For motor operated grilles provide manufacturer's standard cylinder dead lock type locking device on the inside, key operated from both sides, interlocked with motor to prevent motor from operating when locks are activated.

**2.4 ELECTRIC MOTOR OPERATORS**

A. Provide operators complete with electric motor, machine cut reduction gears, steel chain and sprockets, magnetic brake, overload protection, brackets, push button controls, limit switches, magnetic reversing contactor, and other accessories necessary for proper operation including emergency manual operator.

**B. Design:**

1. Design the operator so that the motor may be removed without disturbing the limit-switch timing and without affecting the emergency manual operators.

2. Make provision for emergency manual operation of door by chain-gear mechanism.

3. Arrange the emergency manual operating mechanism so that it may be immediately put into and out of operation from the floor with an electrical or mechanical device, which will disconnect the motor from the operating mechanism when the emergency manual operating mechanism is engaged, and its use shall not affect the timing of the limit switches, in case of electrical failure.

4. Provide interlock with motor to prevent motor from operating when manual locks are activated.

**C. Motors:**

1. Motors shall conform to NEMA MG1, suitable for operation on current of the characteristics indicated, and shall operate at not more

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than 3600 rpm. Single-phase motors shall not have commutation or more than one starting contact. Motor enclosures shall be the drip proof type of NEMA TENV type.

2. Motors shall be high starting torque, reversible type, of sufficient horsepower and torque output to move the door in either direction from any position, and produce a door travel speed of not less than 0.66 foot or more than one foot per second, without exceeding the rated capacity.

**D. Controls:**

1. The control equipment shall conform to NEMA ICS 1 and 2.
2. Control enclosures shall be NEMA ICS 6, Type 12 or Type 4, except that contractor enclosures may be Type 1.
3. Remote control switches shall be at least 1500 mm (5 feet) above the floor line, and located so that the operator will have complete visibility of the door at all times.
4. Each door motor shall have an enclosed, across-the-line type, magnetic reversing contactor, thermal overload protection, solenoid operated brake, limit switches, and remote control switches at locations shown.
5. Use three-button type, push button switch on interior, unless noted to be key activated, with the buttons marked, OPEN, CLOSE, and STOP.
  - a. The OPEN and STOP buttons shall be of the type requiring only momentary pressure to operate. The CLOSE button shall be of the type requiring constant pressure to maintain the closing motion of the door. When the door is in motion, and the STOP button is pressed, the door shall stop instantly and remain in the stop position; from the stop position, the door may then be operated in either direction by the OPEN or Close buttons.
  - b. Push buttons shall be full-guarded to prevent accidental operation.
6. Provide limit switches to automatically stop the doors at their fully open and closed positions. Positions of the limit switches shall be readily adjustable.



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7. Safety device:

- a. The bottom bar of power-operated doors shall have a fail safe safety device that will immediately stop and reverse the door in its closing travel upon contact with an obstruction in the door opening, or upon failure of the device, or any component of the device, or any component of the control system, and cause the door to return to its full open position. The door closing circuit shall be electrically locked out, and the door shall be operable manually until the failure or damage has been corrected.
- b. Safety device shall not be used as a limit switch.
- c. Safety device connecting cable to motor shall be flexible "Type SO" cable and spring loaded automatic take up reel or equivalent device, as required for proper operation of the doors.

8. Transformer:

- a. Provide a control transformer in power circuits as necessary to reduce the voltage on the control circuits to 120 volts or less.
- b. The transformer shall conform to NEMA ST20.

9. Electrical components shall conform to NFPA 70. .

**2.5 FINISHES**

A. Steel:

- 1. Clean surfaces of steel free from scale, rust, oil and grease, and then apply a light colored shop prime paint after fabrication.
- 2. Non-galvanized steel: Treat to assure maximum paint adherence, and apply corrosion inhibitive primer.
- 3. Galvanized steel: Apply a phosphate treatment and a corrosion inhibitive primer.

B. Aluminum: Finish exposed metal surfaces as follows:

- 1. Mill finish, as fabricated.
- 2. AA-C22A41 medium matte, with clear anodic coating, Class I Architectural, 0.7 mils thick.

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**PART 3 - EXECUTION**

**3.1 INSTALLATION**

- A. Install grilles in accordance with approved shop drawings and manufacturer's instructions.
- B. Locate anchors and inserts for guides, brackets, motors, switches, hardware, and other accessories accurately.
- C. Securely attach guides to adjoining construction with not less than 9 mm (3/8 inch) diameter bolts, near each end and spaced not over 600 mm (24 inches) apart.
- D. Locate control switches where shown.
- E. Install all electric devices and wiring as specified in DIVISION 26 ELECTRICAL and DIVISION 28 - ELECTRONIC SAFETY AND SECURITY

**3.2 REPAIR**

- A. Repair prime painted zinc-coated surfaces and bare zinc-coated surfaces that are damaged by the application of galvanizing repair compound. Spot prime all damaged shop prime painted surfaces including repaired prime painted zinc-coated surfaces.
- B. Coiling grilles shall be lubricated, properly adjusted, and demonstrated to operate freely.

**3.3 PROTECTION**

- A. Isolate aluminum in contact with or fastened to dissimilar metals other than stainless steel, white bronze or other metals not compatible with aluminum by one of the following:
  - 1. Paint the dissimilar metal with a prime coat of zinc-Molybdate or other suitable primer, followed by two coats of aluminum paint.
  - 2. Place an approved caulking compound, or a non-absorptive tape, or gasket between the aluminum and the dissimilar metal.
- B. Paint aluminum in contact with or built into mortar, concrete, plaster or other masonry materials with a coat of bituminous paint.

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C. Paint aluminum in contact with wood or other absorptive materials, that may repeatedly become wet, with a coat of bituminous paint or two coats of aluminum paint.

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SECTION 08 34 53

SECURITY DOORS AND FRAMES

PART 1 - GENERAL

1.1 DESCRIPTION

- A. The extent of forced-entry resistant (FE) and ballistic resistant (BR) door assemblies required for the Project is indicated on Contract Drawings, and in Door/Frame/Hardware schedules, including construction, profiles, swing, sizes, hardware, accessories, devices, and locations.

1.2 RELATED WORK

- A. Refer to Division 5, METALS for steel supports.
- B. Doors and frames not designated for special security performances: Section 08 11 13, HOLLOW METAL DOORS AND FRAMES and Section 08 14 00, WOOD DOORS.
- C. Door Hardware: Section 08 71 00, DOOR HARDWARE.
- D. Glazing and ballistic rated glazing: Section 08 80 00, GLAZING.

1.3 PERFORMANCE REQUIREMENTS

- A. General: Fabricate and install FE/BR door assemblies to achieve indicated levels of resistance. Extend resistance to include anchorages, interfaces with adjoining substrates, and hardware. Security attacks shall be unable to penetrate through closed/locked security door assemblies in manner described; it is recognized that such attacks may damage units beyond repair and reuse, requiring replacement of work by Government:
  - 1. Fire-rated assemblies: Where indicated for fire resistance, provide flush steel doors-and-frame units; comply with NFPA 80, Standard for Fire Doors and Windows. Provide units that have been tested by recognized testing agency in accordance with NFPA No. 252 and ASTM E2074:
  - 2. Forced-Entry (FE) resistant assemblies: Where door assembly is shown or scheduled as FE, provide door manufacturer's material and fabrication for panels, inserts, hardware, devices, and framing of units. Provide rated units where shown or scheduled:
    - a. Provide resistance of 15 minutes for forced entry, using basic hand tools.
  - 3. Ballistic Resistant (BR) assemblies: No BR resistance rating.

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**1.4 SUBMITTALS**

- A. General: For each security door assembly, submit the following in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA AND SAMPLES.
1. Product data for each element of work, whether purchased from other manufacturers or provided as door Fabricator's standard production. Include data substantiating that products comply with requirements of these specifications.
  2. Manufacturer's standard color chart.
  3. Certificates: Letter from manufacturer indicating the products have been certified to meet the specified ratings.
  4. Shop drawings showing each dimensioned details of each door assembly, including performance rating, swing, hardware set, and adjacent construction. Provide drawings on B-size 11 in x 17 inch (300 mm x 430 mm) sheets. Show typical door exterior elevations at not less than  $\frac{1}{4}$  inch = 1 foot (1:50) scale. After final modifications and corrections have been incorporated into the drawings, submit drawings as AutoCAD files with DWG extension. Show the following:
    - a. Unit information:
      - 1) Model Number.
      - 2) Marks (window no.).
      - 3) Door/frame finish.
      - 4) Door type.
    - b. Elevation Drawings:
      - 1) Rough opening.
      - 2) Door opening.
      - 3) Frame opening.
      - 4) Vision opening.
      - 5) Finished floor.
      - 6) Sill condition.
      - 7) Undercut for carpet.
      - 8) Reference numbers for primer and finish paint, including number of coats applies.
      - 9) Door class rating: rated or non-rated.
      - 10) Door and frame gauge thickness.

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- c. Plan drawings:
  - 1) Relate to elevation on drawing.
  - 2) Identify "Protected" sides.
  - 3) Identify door swing (i.e., RH, LH, RHRB, LHRB).
  - 4) Provide key on drawings.
  - 5) Indicate room space numbers taken from Contract Drawings.
- d. Details: Show section at not less than  $\frac{3}{4}$  inch = 1 ft (1:20) scale of members indicating construction, size, and thickness of components, frame profile, location of conduit entry, threshold configuration, vision panel together with connections, fastenings, and means of separating dissimilar metals.
- e. Breakdown of Product Line Items:
  - 1) If Manufacturer produces one contract line item as several parts (door with transom and sidelights), they shall breakout items on drawings. Each item shall be a subdivision of that product line item number.
  - 2) Installation instructions shall cite all anchorage components, including complete description of expansion anchor as well as installation criteria such as torque requirements, minimum embedment, and minimum edge distance, and shall include alert to installers to avoid cutting of rebar during concrete anchor installation.

**1.5 QUALITY ASSURANCE**

- A. Testing Laboratory Qualifications: For compliance with non-security performance requirements (such as fire ratings, resistance to deterioration from moisture, accessibility to persons with disabilities, or sound attenuation) on security door assemblies of this Section, use only those testing laboratories which have successfully demonstrated to Project Manager that they have experience and capabilities needed to satisfactorily conduct required tests.
- B. Provide products that have been certified by Bureau of Diplomatic Security (DS) in accordance with DS/PSD SD-STD-01.01.

**1.6 IDENTIFICATION SYSTEMS**

- A. Identify each assembly to provide VA with ready reference to original manufacturer to facilitate reorders, replacement parts, service, resolution of complaints, and inventory. The label shall be typically

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embossed/printed metal plate or metallic foil with adhesive backing for permanent identification. Locate label so that it is readily visible and convenient for identification by Project Manager after installation of assembly. The label shall be approximately 1½ inch x 3 inch (40 x 75 mm) and shall cite:

1. Manufacturer's name/city/state.
2. Contract number.
3. Month/Year of manufacture.
4. Mark number.

**1.7 DELIVERY, STORAGE AND HANDLING**

- A. Deliver each assembly project site with fabrication, finishing, and assembly of primary panels, inserts, and frames completed and prepared for installation and connection with security systems. Disassemble hardware for shipping only to extent hardware interferes with shipping.
- B. Refer to Division One for shipping requirements.
- C. Provide removable spreader bar between jambs during fabrication, delivery, and installation and to include mullions of each frame assembly, except where integral threshold is required and serves same purpose. Do not mar finishes of assembly with installation or removal of spreader bars.
- D. Provide protection of pre-finished units, such as pre-finished with baked enamel or stainless steel, using self-adhesive paper.

**1.8 APPLICABLE PUBLICATIONS**

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.
- B. American National Standards Institute (ANSI):
  1. A250.8-2003 Recommended Specifications for Standard Steel Doors and Frames (formerly SDI-100)
  2. A250.11-2001 Recommended Erection Instructions for Steel Frames (formerly SDI-105)
- C. American Society for Testing and Materials (ASTM):
  1. A153/A153M-09 Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware
  2. A653/A653M-09 Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed)



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3. A1008/A1008M-09            Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Solution Hardened, and Bake Hardenable
4. A1011/A1011M-09a        Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength
5. D1044-08                Standard Test Method for Resistance of Transparent Plastics to Surface Abrasion
6. E2074-00                Standard Test Method for Fire Tests of Door Assemblies, Including Positive Pressure Testing of Side-Hinged and Pivoted Swinging Door Assemblies
- D. National Fire Protection Association (NFPA):
  1. NFPA 80 - 2010 Standard for Fire Doors and Other Opening Protectives
- E. Society for Protective Coatings (SSPC):
  1. SSPC-SP 2 - 2004        Hand Tool Cleaning
  2. SSPC-SP 3 - 2004        Power Tool Cleaning
- F. Underwriters Laboratories, Inc. (UL):
  1. UL752-2006              Bullet Resisting Equipment
- G. United States Department of State Bureau of Diplomatic Security (DS):
  1. SD-STD-01.01-1993      Certification Standard for Forced Entry and Ballistic Resistance of Structural Systems
- H. United States General Services Administration (GSA):
  1. UFAS-1998                Uniform Federal Accessibility Standards

**PART 2 - PRODUCTS**

**2.1 MANUFACTURERS**

- A. Certified units: provide units, including frames and sub-frames which are produced by manufacturer who has previously produced, within last 10 years, units of similar security attack resistance of equivalent size and resistance ratings.

**2.2 MATERIALS, GENERAL**

- A. Hot-Rolled Steel Sheets and Strips: ASTM A1011, commercial quality, pickled and oiled, except as otherwise indicated.
- B. Cold-Rolled Steel Sheets: ASTM A1008, commercial quality, except as

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otherwise indicated.

- C. Galvanized Steel Sheets: ASTM A653 with G90 zinc coating, mill phosphatized; commercial quality, except as otherwise indicated.
- D. Supports and Anchors: Fabricate to endure required performances, but of not less than 1/16 inch (1.5 mm) sheet steel. For exterior wall assemblies, hot-dip zinc coat support/anchor units after fabrication in compliance with ASTM A 153, Class B.
- E. Inserts, Bolts, Fasteners: Standard units of strengths required to endure performances; hot-dip zinc coated where used in exterior wall assemblies in compliance with ASTM A 153, Class C/D.
- F. Vision Lights General: Fabricate vision lights of sizes shown and scheduled with same performance capabilities as specified/shown for door assembly where installed. Where applicable, achieve performances and combined performances through lamination of transparent sheets, films, and screens of standard manufactured/tested products. Comply with applicable provisions of Division 8, Section 08 80 00, GLAZING.
  - 1. Forced-Entry (FE) Resistance: Where assembly is indicated for forced-entry resistance rating (FE), provide light of size shown or scheduled in accordance with certification.
  - 2. Vision light faces general: Except as otherwise shown, where forced-entry or ballistic resistance is required, provide face of light exposed on exterior (to the "attack") as glass surface, and where unit is of laminated construction, provide face exposed on interior ("safe") as polycarbonate surface. Provide exposed polycarbonate surfaces to include an abrasion-resistant coating for 3 percent maximum haze increase for 100 revolutions on 500g Taber abraser, ASTM D 1044.

**2.3 HARDWARE**

- A. General: Provide special units of door hardware to achieve performances, and as shown and scheduled. Standard units for each security door assembly are specified to be furnished as work of Section 08 71 00, DOOR HARDWARE; see Project "Finish Hardware Schedule" and "Data Sheets," and provisions of this Section, as well as notes on door-and-frame schedule.

**2.4 FABRICATION AND ASSEMBLY**

- A. General: Fabricate, test, and preassemble security door assemblies with hardware at factory; disassemble hardware only to extent

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necessary for handling, packaging, shipment, and installation at Project. Fabricate metal work to comply with performance requirements. Fabrications shall be rigid, neat, and free from warp/buckle/similar defects, with eased edges and continuously-welded joints, ground where exposed, to produce smooth, flush, invisible joints. Weld in accordance with AWS D1.1, Structural Welding Code for Steel:

1. Prepare panels and frames of each assembly to receive hardware, devices, and accessory units as shown and scheduled. Reinforce work for hardware and devices, and cut work for mortised or concealed units; comply with ANSI A115 series specifications, working from templates supplied by unit manufacturers and suppliers:
  - a. Locate hardware, devices, and accessories as required by Section 081113, HOLLOW METAL DOORS AND FRAMES, Section 08 14 00, INTERIOR WOOD DOORS, and Section 08 71 00, DOOR HARDWARE.
  - b. Locate hardware, devices, and accessories as shown and scheduled (including on approved shop drawings) or, if not otherwise indicated: 1) in accordance with DHI Recommended Locations for Builder's Hardware or, 2) in accordance with security device manufacturer's recommendation for optimum responses, but 3) in any case, as required to achieve required assembly performances.
  - c. Except where assembly is equipped with door-seal stripping at jambs and head, provide neoprene door silencers on stops; three at strike jamb for single door, and four at head for double door.
  - d. Except as otherwise indicated, pre-fabricate and preassemble security door assemblies to include full extent of required conduit-protected electrical/electronic power-and-control wiring placed and supported to avoid conflicts with other elements and subsequent drilling/cutting-in of work during installation of units. Provide access ports as required to support 1 inch (25 mm) conduit.
  - e. Clearances: Not more than 1/8 inch (3 mm) at jambs and heads, except not more than 1/4 inch (6 mm) between fire-rated pair of doors. Nor more than 1/4 inch (6 mm) at bottom. Undercut for carpets are not permitted where doors are used in corridors. Fabricate frames with horizontally slotted bolt holes.

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2. Provide removable glazing stops and similar moldings on interior or "safe" side of assemblies. Glazing shall be removable without removing door from frame.
3. Shop Painting: Provide base-coat, factory-applied painting of ferrous metal elements of assemblies excluding other specified exposed-finish surfaces of stainless steel, aluminum, bronze, and similar metals not intended for painting.
  - a. Clean steel and zinc-coated steel surfaces of mill scale, rust, oil, grease, dirt and other substances, immediately before finish application.
  - b. Apply pretreatment of cold phosphate solution (SSPC-SP2) or basic zinc chromate/vinyl-butyl solution (SSPC-SP3).
  - c. Apply paint coat specified for shop application, and bake on within time limits recommended by manufacturer of pretreatment. Apply in a uniform, smooth coat to result in dry film thickness of not less than 0.002 inch (0.05 mm).
4. Vision panels:
  - a. The transparencies shall be enclosed and cushioned within core of door for continuous perimeter bite of not less than ¾ inch (20 mm) on each side and 1/4 inch (6 mm) cushion clearance to fixed metal stop on glazing edges. Glazing shall be installed by manufacturer with no raw metal edges evident or in contact with glass in door vision openings. Vision opening edges shall be cushioned and trimmed neatly to provide acceptable appearance.
  - b. If external frames are used to either side or to both faces of door, frame(s) shall not exceed 1-9/16 inch (40 mm) in width and shall be configured internally to cushion all perimeter edges and faces of glazing and provide minimum bite of 3/4 inch (20 mm) and 1/4 inch (6 mm) cushion clearance to fixed metal stop on glazing edges. Frame shall not produce pinch point with hardware. All external bolts to attach frame shall be flush mounted. Alternatively, protruding bolt heads shall be covered with additional trim frame and flush mounted screws.

**PART 3 - EXECUTION**

**3.1 INSTALLATION**

- A. General: Install security door assemblies in accordance with approved

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shop drawings, manufacturer's data and instructions, and requirements of these specifications. Install as required to achieve specified performances, and to comply with recommendations of related industry association or testing agency sponsoring standards for required non-security performances. Install door assemblies plumb and level:

1. Install assemblies in compliance with recommendations and instructions of ANSI A250.8 and ANSI A250.11.
  2. At fire-rated door openings, comply with NFPA Standard No. 80.
  3. Properly hang and align FE/BR doors so that pull open exertion does not exceed 12 lbs (5.4 kg.).
  4. Installer shall not grind any portion of door, frame or locking device strikes.
  5. Locking device strikes shall engage strike plate without binding.
- B. Anchorage: The door manufacturer shall provide anchors appropriate for substrate to which door frame is to be fastened. Structural frames shall have pre-drilled bolt hole patterns not to exceed 12 inches (300 mm) on center. The manufacturer shall verify substrates involved, and supply any special fastening tools (e.g., special drill or bit) required by anchoring system. The anchor shall be acceptable for shock/short duration loading, and have potential for removal during life of building. The anchor shall also meet the following requirements:
1. Anchor diameter: 3/8 inch (10 mm) minimum.
  2. Embedment and edge distances shall be as indicated on Contract Drawings and as appropriate for anchor and substrate, but not less than the following:
    - a. Embedment in concrete: 3 1/2 inches (90 mm).
    - b. Embedment in solid masonry: 6 inches (150 mm).
    - c. Edge distance: 3 inches (75 mm).
  3. The minimum anchor strengths shall be:
    - a. Yield Strength: 135,000 psi (900 MPa)
    - b. Tensile Strength: 186,000 psi (1240 MPa)
  4. Avoid cutting of rebar during concrete anchor installation. Shims provided for rough opening (RO) frame clearance should not exceed 1/4 inch (6 mm). Cap plugs used in frame shall match frame finish.

**3.2 ADJUST AND CLEAN**

- A. General: Upon request of Project Manager, remove protective coverings

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and clean exposed surfaces. Repair damaged elements, restore abraded surfaces, touch-up base-coat paint finish with air-drying primer, and remove imperfections from exposed natural metal finishes.

- B. Check and readjust hardware, devices, and accessories with door-to-frame-and-sill/threshold clearances set for proper operation of locks, door seals, and other operational units. Do not remove permanently applied performance labels.
- C. Comply with "Door Hardware" section requirements for protection and handling of keys and locking devices, and associated information.
- D. Exercise extreme care in the cleaning of exposed surfaces of polycarbonate; comply with manufacturer's directions.

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**SECTION 08 71 00  
DOOR HARDWARE**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

- A. Door hardware and related items necessary for complete installation and operation of doors.

**1.2 RELATED WORK**

- A. Caulking: Section 07 92 00 JOINT SEALANTS.
- B. Application of Hardware: Section 08 14 00, WOOD DOORS, Section 08 11 13, HOLLOW METAL DOORS AND FRAMES
- C. Finishes: Section 09 06 00, SCHEDULE FOR FINISHES.
- D. Painting: Section 09 91 00, PAINTING.
- E. Card Readers: Section 28 13 11, PHYSICAL ACCESS CONTROL SYSTEMS.
- F. Electrical: Division 26, ELECTRICAL.
- G. Fire Detection: Section 28 31 00, FIRE DETECTION AND ALARM.

**1.3 GENERAL**

- A. All hardware shall comply with UFAS, (Uniform Federal Accessible Standards) unless specified otherwise.
- B. Provide rated door hardware assemblies where required by most current version of the International Building Code (IBC).
- C. Hardware for Labeled Fire Doors and Exit Doors: Conform to requirements of NFPA 80 for labeled fire doors and to NFPA 101 for exit doors, as well as to other requirements specified. Provide hardware listed by UL, except where heavier materials, large size, or better grades are specified herein under paragraph HARDWARE SETS. In lieu of UL labeling and listing, test reports from a nationally recognized testing agency may be submitted showing that hardware has been tested in accordance with UL test methods and that it conforms to NFPA requirements.
- D. Hardware for application on metal and wood doors and frames shall be made to standard templates. Furnish templates to the fabricator of these items in sufficient time so as not to delay the construction.
- E. The following items shall be of the same manufacturer, except as otherwise specified:
  - 1. Mortise locksets.
  - 2. Hinges for hollow metal and wood doors.
  - 3. Surface applied overhead door closers.
  - 4. Exit devices.

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**1.4 WARRANTY**

- A. Automatic door operators shall be subject to the terms of FAR Clause 52.246-21, except that the Warranty period shall be two years in lieu of one year for all items except as noted below:
1. Locks, latchsets, and panic hardware: 5 years.
  2. Door closers and continuous hinges: 10 years.

**1.5 MAINTENANCE MANUALS**

- A. In accordance with Section 01 00 00, GENERAL REQUIREMENTS Article titled "INSTRUCTIONS", furnish maintenance manuals and instructions on all door hardware. Provide installation instructions with the submittal documentation.

**1.6 SUBMITTALS**

- A. Submittals shall be in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA AND SAMPLES. Submit 6 copies of the schedule per Section 01 33 23. Submit 2 final copies of the final approved schedules to VAMC Locksmith as record copies (VISN Locksmith if the VAMC does not have a locksmith).
- B. Hardware Schedule: Prepare and submit hardware schedule in the following form:

Hardware Item	Quantity	Size	Reference Publication Type No.	Finish	Mfr. Name and Catalog No.	Key Control Symbols	UL Mark (if fire rated and listed)	ANSI/BHMA Finish Designation

- C. Samples and Manufacturers' Literature:

1. Samples: All hardware items (proposed for the project) that have not been previously approved by Builders Hardware Manufacturers Association shall be submitted for approval. Tag and mark all items with manufacturer's name, catalog number and project number.
2. Samples are not required for hardware listed in the specifications by manufacturer's catalog number, if the contractor proposes to use the manufacturer's product specified.

- D. Certificate of Compliance and Test Reports: Submit certificates



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that hardware conforms to the requirements specified herein. Certificates shall be accompanied by copies of reports as referenced. The testing shall have been conducted either in the manufacturer's plant and certified by an independent testing laboratory or conducted in an independent laboratory, within four years of submittal of reports for approval.

**1.7 DELIVERY AND MARKING**

- A. Deliver items of hardware to job site in their original containers, complete with necessary appurtenances including screws, keys, and instructions. Tag one of each different item of hardware and deliver to Resident Engineer for reference purposes. Tag shall identify items by Project Specification number and manufacturer's catalog number. These items shall remain on file in Resident Engineer's office until all other similar items have been installed in project, at which time the Resident Engineer will deliver items on file to Contractor for installation in predetermined locations on the project.

**1.8 PREINSTALLATION MEETING**

- A. Convene a pre-installation meeting not less than 30 days before start of installation of door hardware. Require attendance of parties directly affecting work of this section, including Contractor and Installer, Architect, Project Engineer and VA Locksmith, Hardware Consultant, and Hardware Manufacturer's Representative. Review the following:
  - 1. Inspection of door hardware.
  - 2. Job and surface readiness.
  - 3. Coordination with other work.
  - 4. Protection of hardware surfaces.
  - 5. Substrate surface protection.
  - 6. Installation.
  - 7. Adjusting.
  - 8. Repair.
  - 9. Field quality control.
  - 10. Cleaning.

**1.9 INSTRUCTIONS**

- A. Hardware Set Symbols on Drawings: Except for protective plates, door stops, mates, thresholds and the like specified herein, hardware requirements for each door are indicated on drawings by

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symbols. Symbols for hardware sets consist of letters (e.g., "HW") followed by a number. Each number designates a set of hardware items applicable to a door type.

- B. Keying: All cylinders shall be keyed into existing Best Great Master Key System. Provide removable core cylinders that are removable only with a special key or tool without disassembly of knob or lockset. Cylinders shall be 7 pin type. Keying information shall be furnished at a later date by the Resident Engineer.

**1.10 APPLICABLE PUBLICATIONS**

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only. In text, hardware items are referred to by series, types, etc., listed in such specifications and standards, except as otherwise specified.

- B. American Society for Testing and Materials (ASTM):

F883-04.....Padlocks

E2180-07.....Standard Test Method for Determining the  
Activity of Incorporated Antimicrobial  
Agent(s) In Polymeric or Hydrophobic  
Materials

- C. American National Standards Institute/Builders Hardware  
Manufacturers Association (ANSI/BHMA):

A156.1-06.....Butts and Hinges

A156.2-03.....Bored and Pre-assembled Locks and Latches

A156.3-08.....Exit Devices, Coordinators, and Auto  
Flush Bolts

A156.4-08.....Door Controls (Closers)

A156.5-01.....Auxiliary Locks and Associated Products

A156.6-05.....Architectural Door Trim

A156.8-05.....Door Controls-Overhead Stops and Holders

A156.12-05 .....Interconnected Locks and Latches

A156.13-05.....Mortise Locks and Latches Series 1000

A156.14-07 .....Sliding and Folding Door Hardware

A156.15-06.....Release Devices-Closer Holder,  
Electromagnetic and Electromechanical

A156.16-08.....Auxiliary Hardware

A156.17-04 .....Self-Closing Hinges and Pivots

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- A156.18-06.....Materials and Finishes
- A156.20-06 .....Strap and Tee Hinges, and Hasps
- A156.21-09.....Thresholds
- A156.22-05.....Door Gasketing and Edge Seal Systems
- A156.23-04.....Electromagnetic Locks
- A156.24-03.....Delayed Egress Locking Systems
- A156.25-07 .....Electrified Locking Devices
- A156.26-06.....Continuous Hinges
- A156.28-07 .....Master Keying Systems
- A156.29-07 .....Exit Locks and Alarms
- A156.30-03 .....High Security Cylinders
- A156.31-07 .....Electric Strikes and Frame Mounted  
Actuators
- A250.8-03.....Standard Steel Doors and Frames
- D. National Fire Protection Association (NFPA):
  - 80-10.....Fire Doors and Fire Windows
  - 101-09.....Life Safety Code
- E. Underwriters Laboratories, Inc. (UL):
  - Building Materials Directory (2008)

**PART 2 - PRODUCTS**

SPEC WRITER NOTE: Under "Hardware Sets", schedule special hinges for doors over 1200 mm (4 feet) wide and other special doors. Also schedule special hinges such as spring hinges and strap hinges.

**2.1 BUTT HINGES**

- A. ANSI A156.1. Provide only three-knuckle hinges, except five-knuckle where the required hinge type is not available in a three-knuckle version (e.g., some types of swing-clear hinges). The following types of butt hinges shall be used for the types of doors listed, except where otherwise specified:
  - 1. Exterior Doors: Type A2112/A5112 for doors 900 mm (3 feet) wide or less and Type A2111/A5111 for doors over 900 mm (3 feet) wide. Hinges for exterior outswing doors shall have non-removable pins. Hinges for exterior fire-rated doors shall be of stainless steel material.
  - 2. Interior Doors: Type A8112/A5112 for doors 900 mm (3 feet) wide or less and Type A8111/A5111 5' x 4 ½", for doors over

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900 mm (3 feet) wide. Hinges for doors exposed to high humidity areas (shower rooms, toilet rooms, kitchens, janitor rooms, etc. shall be of stainless steel material.

- B. Provide quantity and size of hinges per door leaf as follows:
1. Doors up to 1210 mm (4 feet) high: 2 hinges.
  2. Doors 1210 mm (4 feet) to 2260 mm (7 feet 5 inches) high: 3 hinges minimum.
  3. Doors greater than 2260 mm (7 feet 5 inches) high: 4 hinges.
  4. Doors up to 900 mm (3 feet) wide, standard weight: 114 mm x 114 mm (4-1/2 inches x 4-1/2 inches) hinges.
  5. Doors over 900 mm (3 feet) to 1065 mm (3 feet 6 inches) wide, standard weight: 127 mm x 114 mm (5 inches x 4-1/2 inches).
  6. Doors over 1065 mm (3 feet 6 inches) to 1210 mm (4 feet), heavy weight: 127 mm x 114 mm (5 inches x 4-1/2 inches).
  7. Provide heavy-weight hinges where specified.
  8. At doors weighing 330 kg (150 lbs.) or more, furnish 127 mm (5 inch) high hinges.
- C. See Articles "MISCELLANEOUS HARDWARE" and "HARDWARE SETS" for pivots and hinges other than butts specified above and continuous hinges specified below.

**2.2 CONTINUOUS HINGES**

- A. ANSI/BHMA A156.26, Grade 1-600.
1. Listed under Category N in BHMA's "Certified Product Directory."
- B. General: Minimum 0.120-inch- (3.0-mm-) thick, hinge leaves with minimum overall width of 4 inches (102 mm); fabricated to full height of door and frame and to template screw locations; with components finished after milling and drilling are complete
- C. Continuous, Barrel-Type Hinges: Hinge with knuckles formed around a Teflon-coated 6.35mm (0.25-inch) minimum diameter pin that extends entire length of hinge.
1. Base Metal for Exterior Hinges: Stainless steel.
  2. Base Metal for Interior Hinges: Stainless steel.
  3. Base Metal for Hinges for Fire-Rated Assemblies: Stainless steel.
  4. Provide with non-removable pin (hospital tip option) at lockable outswing doors.
  5. Where required to clear adjacent casing, trim, and wall

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conditions and allow full door swing, provide wide throw hinges of minimum width required.

6. Provide with manufacturer's cut-outs for separate mortised power transfers and/or mortised automatic door bottoms where they occur.
7. Where thru-wire power transfers are integral to the hinge, provide hinge with easily removable portion to allow easy access to wiring connections.
8. Where models are specified that provide an integral wrap-around edge guard for the hinge edge of the door, provide manufacturer's adjustable threaded stud and machine screw mechanism to allow the door to be adjusted within the wrap-around edge guard.

**2.3 DOOR CLOSING DEVICES**

- A. Closing devices shall be products of one manufacturer for each type specified.

**2.4 OVERHEAD CLOSERS**

- A. Conform to ANSI A156.4, Grade 1.
- B. Closers shall conform to the following:
  1. The closer shall have minimum 50 percent adjustable closing force over minimum value for that closer and have adjustable hydraulic back check effective between 60 degrees and 85 degrees of door opening.
  2. Where specified, closer shall have hold-open feature.
  3. Size Requirements: Provide multi-size closers, sizes 1 through 6, except where multi-size closer is not available for the required application.
  4. Material of closer body shall be forged or cast.
  5. Arm and brackets for closers shall be steel, malleable iron or high strength ductile cast iron.
  6. Where closers are exposed to the exterior or are mounted in rooms that experience high humidity, provide closer body and arm assembly of stainless steel material.
  7. Closers shall have full size metal cover; plastic covers will not be accepted.
  8. Closers shall have adjustable hydraulic back-check, separate valves for closing and latching speed, adjustable back-check positioning valve, and adjustable delayed action valve.

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9. Provide closers with any accessories required for the mounting application, including (but not limited to) drop plates, special soffit plates, spacers for heavy-duty parallel arm fifth screws, bull-nose or other regular arm brackets, longer or shorter arm assemblies, and special factory templating. Provide special arms, drop plates, and templating as needed to allow mounting at doors with overhead stops and/or holders.
10. Closer arms or backcheck valve shall not be used to stop the door from overswing, except in applications where a separate wall, floor, or overhead stop cannot be used.
11. Provide parallel arm closers with heavy duty rigid arm.
12. Where closers are to be installed on the push side of the door, provide parallel arm type except where conditions require use of top jamb arm.
13. Provide all surface closers with the same body attachment screw pattern for ease of replacement and maintenance.
14. All closers shall have a 1 ½" (38mm) minimum piston diameter.

**2.5 DOOR STOPS**

- A. Conform to ANSI A156.16.
- B. Provide door stops wherever an opened door or any item of hardware thereon would strike a wall, column, equipment or other parts of building construction. For concrete, masonry or quarry tile construction, use lead expansion shields for mounting door stops.
- C. Where cylindrical locks with turn pieces or pushbuttons occur, equip wall bumpers Type L02251 (rubber pads having concave face) to receive turn piece or button.
- D. Provide floor stops (Type L02141 or L02161 in office areas; Type L02121 x 3 screws into floor elsewhere. Wall bumpers, where used, must be installed to impact the trim or the door within the leading half of its width. Floor stops, where used, must be installed within 4-inches of the wall face and impact the door within the leading half of its width.
- E. Where drywall partitions occur, use floor stops, Type L02141 or L02161 in office areas, Type L02121 elsewhere.
- F. Provide stop Type L02011, as applicable for exterior doors. At outswing doors where stop can be installed in concrete, provide stop mated to concrete anchor set in 76mm (3-inch) core-drilled

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- hole and filled with quick-setting cement.
- G. Omit stops where floor mounted door holders are required and where automatic operated doors occur.
  - H. Provide appropriate roller bumper for each set of doors (except where closet doors occur) where two doors would interfere with each other in swinging.
  - I. Provide appropriate door mounted stop on doors in individual toilets where floor or wall mounted stops cannot be used.
  - J. Provide overhead surface applied stop Type C02541, ANSI A156.8 on patient toilet doors in bedrooms where toilet door could come in contact with the bedroom door.
  - K. Provide door stops on doors where combination closer magnetic holders are specified, except where wall stops cannot be used or where floor stops cannot be installed within 4-inches of the wall.
  - L. Where the specified wall or floor stop cannot be used, provide concealed overhead stops (surface-mounted where concealed cannot be used).

**2.6 OVERHEAD DOOR STOPS AND HOLDERS**

- A. Conform to ANSI Standard A156.8. Overhead holders shall be of sizes recommended by holder manufacturer for each width of door. Set overhead holders for 110 degree opening, unless limited by building construction or equipment. Provide Grade 1 overhead concealed slide type: stop-only at rated doors and security doors, hold-open type with exposed hold-open on/off control at all other doors requiring overhead door stops.

**2.7 LOCKS AND LATCHES**

- A. Conform to ANSI A156.2. Locks and latches for doors 45 mm (1-3/4 inch) thick or over shall have beveled fronts. Lock cylinders shall have not less than // six pins // seven pins //. Cylinders for all locksets shall be removable core type. // Cylinders shall be furnished with construction removable cores and construction master keys. // Cylinder shall be removable by special key or tool. Construct all cores so that they will be interchangeable into the core housings of all mortise locks, rim locks, cylindrical locks, and any other type lock included in the Great Grand Master Key System. Disassembly of lever or lockset shall

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not be required to remove core from lockset. All locksets or latches on double doors with fire label shall have latch bolt with 19 mm (3/4 inch) throw, unless shorter throw allowed by the door manufacturer's fire label. Provide temporary keying device or construction core of allow opening and closing during construction and prior to the installation of final cores. mortise lock case.

1. Cylindrical Lock and Latch Sets: levers shall meet ADA (Americans with Disabilities Act) requirements. Cylindrical locksets shall be series 4000 Grade I. All locks and latchsets shall be furnished with 122.55 mm (4-7/8-inch) curved lip strike and wrought box. At outswing pairs with overlapping astragals, provide flat lip strip with 21mm (7/8-inch) lip-to-center dimension. Provide lever design to match design selected by Architect or to match existing lever design. Where two turn pieces are specified for lock F76, turn piece on inside knob shall lock and unlock inside knob, and turn piece on outside knob shall unlock outside knob when inside knob is in the locked position. (This function is intended to allow emergency entry into these rooms without an emergency key or any special tool.)
3. Auxiliary locks shall be as specified under hardware sets and conform to ANSI A156.5.
4. Privacy locks in non-mental-health patient rooms shall have an inside thumbturn for privacy and an outside thumbturn for emergency entrance. Single occupancy patient privacy doors shall typically swing out; where such doors cannot swing out, provide center-pivoted doors with rescue hardware (see HW-2B).

**2.08 PUSH-BUTTON COMBINATION LOCKS**

- A. ANSI/BHMA A156.13, Grade 1. Battery operated pushbutton entry.
- B. Construction: Heavy duty mortise lock housing conforming to ANSI/BHMA A156.13, Grade 1. Lever handles and operating components in compliance with the UFAS and the ADA Accessibility Guidelines. Match lever handles of locks and latchsets on adjacent doors.
- C. Special Features: Key override to permit a master keyed security system and a pushbutton security code activated passage feature to allow access without using the entry code.



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**2.09 KEYS**

- A. Stamp all keys with change number and key set symbol. Furnish keys in quantities as follows:

<b>Locks/Keys</b>	<b>Quantity</b>
Cylinder locks	2 keys each
Cylinder lock change key blanks	100 each different key way
Master-keyed sets	6 keys each
Grand Master sets	6 keys each
Great Grand Master set	5 keys
Control key	2 keys

**2.10 ARMOR PLATES, KICK PLATES, MOP PLATES AND DOOR EDGING**

- A. Conform to ANSI Standard A156.6.
- B. Provide protective plates as specified below:
- Kick plates, mop plates and armor plates of metal, Type J100 series.
  - Provide kick plates and mop plates where specified. Kick plates shall be 254 mm (10 inches) or 305 mm (12 inches) high. Mop plates shall be 152 mm (6 inches) high. Both kick and mop plates shall be minimum 1.27 mm (0.050 inches) thick. Provide kick and mop plates beveled on all 4 edges (B4E). On push side of doors where jamb stop extends to floor, make kick plates 38 mm (1-1/2 inches) less than width of door, except pairs of metal doors which shall have plates 25 mm (1 inch) less than width of each door. Extend all other kick and mop plates to within 6 mm (1/4 inch) of each edge of doors. Kick and mop plates shall butt astragals. For jamb stop requirements, see specification sections pertaining to door frames.
  - Kick plates and/or mop plates are not required on following door sides:
    - Armor plate side of doors;
    - Exterior side of exterior doors;
    - Closet side of closet doors;
    - Both sides of aluminum entrance doors.
  - Armor plates for doors are listed under Article "Hardware Sets". Armor plates shall be thickness as noted in the

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hardware set, 875 mm (35 inches) high and 38 mm (1-1/2 inches) less than width of doors, except on pairs of metal doors.

Provide armor plates beveled on all 4 edges (B4E). Plates on pairs of metal doors shall be 25 mm (1 inch) less than width of each door. Where top of intermediate rail of door is less than 875 mm (35 inches) from door bottom, extend armor plates to within 13 mm (1/2 inch) of top of intermediate rail. On doors equipped with panic devices, extend armor plates to within 13 mm (1/2 inch) of panic bolt push bar.

5. Where louver or grille occurs in lower portion of doors, substitute stretcher plate and kick plate in place of armor plate. Size of stretcher plate and kick plate shall be 254 mm (10 inches) high.

**2.11 EXIT DEVICES**

- A. Conform to ANSI Standard A156.3. Exit devices shall be Grade 1; type and function are specified in hardware sets. Provide flush with finished floor strikes for vertical rod exit devices in interior of building. Trim shall have cast satin stainless steel lever handles of design similar to locksets, unless otherwise specified. Provide key cylinders for keyed operating trim and, where specified, cylinder dogging.
- B. Surface vertical rod panics shall only be provided less bottom rod; provide fire pins as required by exit device and door fire labels. Do not provide surface vertical rod panics at exterior doors.
- C. Concealed vertical rod panics shall be provided less bottom rod at interior doors, unless lockable or otherwise specified; provide fire pins as required by exit device and door fire labels. Where concealed vertical rod panics are specified at exterior doors, provide with both top and bottom rods.
- D. Where removable mullions are specified at pairs with rim panic devices, provide mullion with key-removable feature.
- E. At non-rated openings with panic hardware, provide panic hardware with key cylinder dogging feature.
- F. Exit devices for fire doors shall comply with Underwriters Laboratories, Inc., requirements for Fire Exit Hardware. Submit proof of compliance.

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**2.12 FLUSH BOLTS (LEVER EXTENSION)**

- A. Conform to ANSI A156.16. Flush bolts shall be Type L24081 unless otherwise specified. Furnish proper dustproof strikes conforming to ANSI A156.16, for flush bolts required on lower part of doors.
- B. Lever extension manual flush bolts shall only be used at non-fire-rated pairs for rooms only accessed by maintenance personnel.
- C. Face plates for cylindrical strikes shall be rectangular and not less than 25 mm by 63 mm (1 inch by 2-1/2 inches).
- D. Friction-fit cylindrical dustproof strikes with circular face plate may be used only where metal thresholds occur.
- E. Provide extension rods for top bolt where door height exceeds 2184 mm (7 feet 2 inches).

**2.13 FLUSH BOLTS (AUTOMATIC)**

- A. Conform to ANSI A156.3. Dimension of flush bolts shall conform to ANSI A115. Bolts shall conform to Underwriters Laboratories, Inc., requirements for fire door hardware. Flush bolts shall automatically latch and unlatch. Furnish dustproof strikes conforming to ANSI A156.16 for bottom flushbolt. Face plates for dustproof strike shall be rectangular and not less than 38 mm by 90 mm (1-1/2 by 3-1/2 inches).

**2.14 DOOR PULLS WITH PLATES**

- A. Conform to ANSI A156.6. Pull Type J401, 152 mm (6 inches) high by 19 mm (3/4 inches) diameter with plate Type J302, 90 mm by 350 mm (3-1/2 inches by 14 inches), unless otherwise specified. Provide pull with projection of 70 mm (2 3/4 inches) and a clearance of 51 mm (2 inches). Cut plates of door pull plate for cylinders, or turn pieces where required.

**2.15 PUSH PLATES**

- A. Conform to ANSI A156.6. Metal, Type J302, 200 mm (8 inches) wide by 350 mm (14 inches) high. Provide metal Type J302 plates 100 mm (4 inches wide by 350 mm (14 inches) high) where push plates are specified for doors with stiles less than 200 mm (8 inches) wide. Cut plates for cylinders, and turn pieces where required.

**2.16 COMBINATION PUSH AND PULL PLATES**

- A. Conform to ANSI 156.6. Type J303, stainless steel 3 mm (1/8 inch) thick, 80 mm (3-1/3 inches) wide by 800 mm (16 inches) high), top and bottom edges shall be rounded. Secure plates to wood doors with 38 mm (1-1/2 inch) long No. 12 wood screws. Cut plates for

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turn pieces, and cylinders where required. Pull shall be mounted down.

**2.17 COORDINATORS**

- A. Conform to ANSI A156.16. Coordinators, when specified for fire doors, shall comply with Underwriters Laboratories, Inc., requirements for fire door hardware. Coordinator may be omitted on exterior pairs of doors where either door will close independently regardless of the position of the other door. Coordinator may be omitted on interior pairs of non-labeled open where open back strike is used. Open back strike shall not be used on labeled doors. Paint coordinators to match door frames, unless coordinators are plated. Provide bar type coordinators, except where gravity coordinators are required at acoustic pairs. For bar type coordinators, provide filler bars for full width and, as required, brackets for push-side surface mounted closers, overhead stops, and vertical rod panic strikes.

**2.18 THRESHOLDS**

- A. Conform to ANSI A156.21, mill finish extruded aluminum, except as otherwise specified. In existing construction, thresholds shall be installed in a bed of sealant with ¼-20 stainless steel machine screws and expansion shields. In new construction, embed aluminum anchors coated with epoxy in concrete to secure thresholds. Furnish thresholds for the full width of the openings.
- B. For thresholds at elevators entrances see other sections of specifications.
- C. At exterior doors and any interior doors exposed to moisture, provide threshold with non-slip abrasive finish.
- D. Provide with miter returns where threshold extends more than 12 mm (0.5 inch) from frame face.

**2.19 MISCELLANEOUS HARDWARE**

- A. Silencers: Conform to ANSI A156.16. Provide door mutes or door silencers Type L03011 or L03021, depending on frame material, of white or light gray color, on each steel or wood door frame, except at fire-rated frames, lead-lined frames and frames for sound-resistant, lightproof and electromagnetically shielded doors. Furnish 3 mutes for single doors and 2 mutes for each pair of doors, except double-acting doors. Provide 4 mutes or

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silencers for frames for each Dutch type door. Provide 2 mutes for each edge of sliding door which would contact door frame.

**2.20 FINISHES**

- A. Exposed surfaces of hardware shall have ANSI A156.18, finishes as specified below. Finishes on all hinges, pivots, closers, thresholds, etc., shall be as specified below under "Miscellaneous Finishes." For field painting (final coat) of ferrous hardware, see Section 09 91 00, PAINTING.
- B. 626 or 630: All surfaces on exterior and interior of buildings, except where other finishes are specified.
- C. Miscellaneous Finishes:
1. Hinges --exterior doors: 626 or 630.
  2. Hinges --interior doors: 652 or 630.
  3. Pivots: Match door trim.
  4. Door Closers: Factory applied paint finish. Dull or Satin Aluminum color.
  5. Thresholds: Mill finish aluminum.
  6. Cover plates for floor hinges and pivots: 630.
  7. Other primed steel hardware: 600.
- D. Hardware Finishes for Existing Buildings: U.S. Standard finishes shall match finishes of hardware in (similar) existing spaces // except where otherwise specified. //
- E. Anti-microbial Coating: All hand-operated hardware (levers, pulls, push bars, push plates, paddles, and panic bars) shall be provided with an anti-microbial/anti-fungal coating that has passed ASTM E2180 tests. Coating to consist of ionic silver (Ag+). Silver ions surround bacterial cells, inhibiting growth of bacteria, mold, and mildew by blockading food and respiration supplies.

**2.21 BASE METALS**

- A. Apply specified U.S. Standard finishes on different base metals as following:

Finish	Base Metal
652	Steel
626	Brass or bronze
630	Stainless steel

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**PART 3 - EXECUTION**

**3.1 HARDWARE HEIGHTS**

- A. For existing buildings locate hardware on doors at heights to match existing hardware. The Contractor shall visit the site, verify location of existing hardware and submit locations to VA Resident Engineer for approval.
- B. Hardware Heights from Finished Floor:
1. Exit devices centerline of strike (where applicable) 1024 mm (40-5/16 inches).
  2. Locksets and latch sets centerline of strike 1024 mm (40-5/16 inches).
  3. Deadlocks centerline of strike 1219 mm (48 inches).
  4. Hospital arm pull 1168 mm (46 inches) to centerline of bottom supporting bracket.
  5. Centerline of door pulls to be 1016 mm (40 inches).
  6. Push plates and push-pull shall be 1270 mm (50 inches) to top of plate.
  7. Push-pull latch to be 1024 mm (40-5/16 inches) to centerline of strike.
  8. Locate other hardware at standard commercial heights. Locate push and pull plates to prevent conflict with other hardware.

**3.2 INSTALLATION**

- A. Closer devices, including those with hold-open features, shall be equipped and mounted to provide maximum door opening permitted by building construction or equipment. Closers shall be mounted on side of door inside rooms, inside stairs, and away from corridors. At exterior doors, closers shall be mounted on interior side. Where closers are mounted on doors they shall be mounted with sex nuts and bolts; foot shall be fastened to frame with machine screws.

B. Hinge Size Requirements:

Door Thickness	Door Width	Hinge Height
45 mm (1-3/4 inch)	900 mm (3 feet) and less	113 mm (4-1/2 inches)
45 mm (1-3/4 inch)	Over 900 mm (3 feet) but not more than 1200 mm (4 feet)	125 mm (5 inches)
35 mm (1-3/8 inch)	Not over 1200 mm (4 feet)	113 mm (4-1/2 inches)

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(hollow core wood doors)		
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C. Hinge leaves shall be sufficiently wide to allow doors to swing clear of door frame trim and surrounding conditions.

D. Hinges Required Per Door:

Doors 1500 mm (5 ft) or less in height	2 butts
Doors over 1500 mm (5 ft) high and not over 2280 mm (7 ft 6 in) high	3 butts
Doors over 2280 mm (7 feet 6 inches) high	4 butts
Dutch type doors	4 butts
Doors with spring hinges 1370 mm (4 feet 6 inches) high or less	2 butts
Doors with spring hinges over 1370 mm (4 feet 6 inches)	3 butts

E. Fastenings: Suitable size and type and shall harmonize with hardware as to material and finish. Provide machine screws and lead expansion shields to secure hardware to concrete, ceramic or quarry floor tile, or solid masonry. Fiber or rawl plugs and adhesives are not permitted. All fastenings exposed to weather shall be of nonferrous metal.

F. After locks have been installed; show in presence of Resident Engineer that keys operate their respective locks in accordance with keying requirements. (All keys, Master Key level and above shall be sent Registered Mail to the Medical Center Director along with the bitting list. Also a copy of the invoice shall be sent to the Resident Engineer for his records.) Installation of locks which do not meet specified keying requirements shall be considered sufficient justification for rejection and replacement of all locks installed on project.

### **3.3 FINAL INSPECTION**

A. Installer to provide letter to VA Resident/Project Engineer that upon completion, installer has visited the Project and has accomplished the following:

1. Re-adjust hardware.
2. Evaluate maintenance procedures and recommend changes or additions, and instruct VA personnel.
3. Identify items that have deteriorated or failed.

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4. Submit written report identifying problems.

**3.4 DEMONSTRATION**

A. Demonstrate efficacy of mechanical hardware and electrical, and electronic hardware systems, including adjustment and maintenance procedures, to satisfaction of Resident/Project Engineer and VA Locksmith.

**3.5 HARDWARE SETS**

A. Following sets of hardware correspond to hardware symbols shown on drawings. Only those hardware sets that are shown on drawings will be required. Disregard hardware sets listed in specifications but not shown on drawings.

B. Hardware Consultant working on a project will be responsible for providing additional information regarding these hardware sets. The numbers shown in the following sets come from BHMA standards.

**INTERIOR SINGLE DOORS**

HW-1

THIS SET NOT USED.

HW-1A

Each Door to Have:

RATED

1	Continuous Hinge	
1	Latchset	Best 93K70-N x 15C
1	Closer	C02021
1	Kick Plate	J102
1	Mop Plate	J103
1	Wall Stop	L02251 CONCAVE
3	Silencers	L03011

HW-1B

THIS SET NOT USED.

HW-1C

THIS SET NOT USED.



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HW-1D

THIS SET NOT USED.

HW-1E

THIS SET NOT USED.

HW-1F

Each Door to Have:

NON-RATED

Hinges	QUANTITY & TYPE AS REQUIRED
1 Latchset	Best 93K0-N x 15C
1 Kick Plate	J102
1 Wall Stop	L02151 CONCAVE
1 set Sound Seals	Zero 870A jambs/head (or approved equal)
1 Door Bottom	Zero 367A (or approved equal)

HW-1G

Each Door to Have:

NON-RATED

Hinges	QUANTITY & TYPE AS REQUIRED
1 Latchset	Best 93K0-N x 15C
1 Kick Plate	J102
1 Wall Stop	L02151 CONCAVE
3 Silencers	L03011

HW-1H

THIS SET NOT USED.

HW-1J

THIS SET NOT USED.

HW-1K

THIS SET NOT USED.

HW-1L

THIS SET NOT USED.

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HW-1M

THIS SET NOT USED.

HW-1N

THIS SET NOT USED.

HW-1P

THIS SET NOT USED.

HW-1Q

THIS SET NOT USED.

HW-1R

THIS SET NOT USED.

HW-1S

Hinges	QUANTITY & TYPE AS REQUIRED
1 Latchset	Best 93K70-N x 15C
1 Closer	C02021
1 Mop Plate	J103
1 Wall Stop	L02251 CONCAVE
3 Silencers	L03011

HW-2

Each Door to Have:

NON-RATED

Hinges	QUANTITY & TYPE AS REQUIRED
1 Keyed Privacy Indicator Lock	F13 x OCCUPANCY INDICATOR
1 Closer	C02011/C02021
1 Kick Plate	J102
1 Mop Plate (@ Inswing Doors)	J103
1 Floor Stop	L02151 Concave
1 set Sound Seals	Zero 870A jambs/head (or approved equal)
1 Door Bottom	Zero 367A (or approved equal)

HW-2A

THIS SET NOT USED.

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HW-2B

Each Door to Have:

NON-RATED

1	Center Pivot Set	C07042
1	Privacy Lock	F02-MOD x THUMBTURN BOTH SIDES X
		OCCUPANCY INDICATOR
1	Rescue Stop	A1882
1	Kick Plate	J102
1	Mop Plate (@ Inswing Doors)	J103
1	Wall Stop	L02151 Concave
1	Sight Seal	Zero 137P or approved equal

HW-2C

Each Door to Have:

NON-RATED

	Hinges	QUANTITY & TYPE AS REQUIRED
1	Privacy Lock	Best 93K0-L x 15C
1	Kick Plate	J102
1	Mop Plate (@ Inswing Doors)	J103
1	Wall Stop	L02151 Concave
3	Silencers	L03011

HW-2D

THIS SET NOT USED.

HW-2E

THIS SET NOT USED.

HW-2F

THIS SET NOT USED.

HW-2G

THIS SET NOT USED.

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HW-2H

THIS SET NOT USED.

HW-2J

Each Door to Have:

NON-RATED

THIS SET NOT USED.

HW-2K

THIS SET NOT USED.

HW-3

Each Door to Have:

NON-RATED

Hinges	QUANTITY & TYPE AS REQUIRED
1 Office Lock	Best 93K7-AB-15C
1 Kick Plate	J102
1 Floor Stop	L02141
3 Silencers	L03011

HW-3A

Each Door to Have:

NON-RATED

Hinges	QUANTITY & TYPE AS REQUIRED
1 Office Lock	Best 93K7-AB-15C
1 Kick Plate	J102
1 Floor Stop	L02141
1 set Sound Seals	Zero 870A jambs/head (or approved equal)
1 Door Bottom	Zero 367A (or approved equal)

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<u>Each Door to Have:</u>	<u>HW-3B</u>	<u>NON-RATED</u>
Hinges	QUANTITY & TYPE AS REQUIRED	
1 Office Lock	Best 93K7-AB-15C	
1 Closer	C02011/C02021	
1 Wall Stop	L02151	
3 Silencers	L03011	
	<u>HW-3C</u>	
THIS SET NOT USED.		
	<u>HW-3D</u>	
THIS SET NOT USED.		
	<u>HW-3E</u>	
THIS SET NOT USED.		
	<u>HW-3F</u>	
THIS SET NOT USED.		
	<u>HW-3G</u>	
THIS SET NOT USED.		
	<u>HW-3H</u>	
THIS SET NOT USED.		
	<u>HW-3J</u>	
THIS SET NOT USED.		

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HW-4

Each Door to Have:

NON-RATED

	QUANTITY & TYPE AS REQUIRED
Hinges	
1 Classroom Lock	Best 93K7-J-15C
1 Closer	C02011/C02021
1 Kick Plate	J102
1 Mop Plate	J103
1 Wall Stop	L02251 Concave
1 set Sound Seals	Zero 870A jambs/head (or approved equal)
1 Door Bottom	Zero 367A (or approved equal

HW-4A

THIS SET NOT USED.

HW-4B

Each Door to Have:

NON-RATED

1 Continuous Hinge	
1 Public Restroom Lock	Best 93K7-C x 15C
1 Closer	C02011/C02021
1 Kick Plate	J102
1 Mop Plate	J103
1 Wall Stop	L02251 Concave
1 set Sound Seals	Zero 870A jambs/head (or approved equal)
1 Door Bottom	Zero 367A (or approved equal

HW-4C

THIS SET NOT USED.

HW-4D

THIS SET NOT USED.

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HW-4E

Each Door to Have:

NON-RATED

	QUANTITY & TYPE AS REQUIRED
Hinges	
1 Classroom Lock	Best 93K7-J-15C
1 Kick Plate	J102
1 Wall Stop	L02251 Concave
1 set Sound Seals	Zero 870A jambs/head (or approved equal)
1 Door Bottom	Zero 367A (or approved equal

HW-4F

Each Door to Have:

NON-RATED

	QUANTITY & TYPE AS REQUIRED
Hinges	
1 Classroom Lock	Best 93K7-J-15C
1 Kick Plate	J102
1 Wall Stop	L02251 Concave
3 Silencers	L03011

HW-4G

THIS SET NOT USED.

HW-4H

THIS SET NOT USED.

HW-4J

THIS SET NOT USED.

HW-4K

THIS SET NOT USED.

HW-4L

THIS SET NOT USED.

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HW-4M

THIS SET NOT USED.

HW-4N

THIS SET NOT USED.

HW-4P

THIS SET NOT USED.

HW-4Q

THIS SET NOT USED.

HW-4R

THIS SET NOT USED.

HW-4S

THIS SET NOT USED.

HW-4T

THIS SET NOT USED.

HW-4U

THIS SET NOT USED.

HW-4V

THIS SET NOT USED.

HW-4X

THIS SET NOT USED.

HW-4Y

THIS SET NOT USED.



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HW-5

Each Door to Have:

RATED

	Hinges	QUANTITY & TYPE AS REQUIRED
1	Storeroom Lock	Best 93K7-D-15C
1	Closer	C02011/C02021
1	Kick Plate	J102
1	Floor Stop	L02121 x 3 FASTENERS
1	Set Self-Adhesive Seals	R0Y154

Note: Storeroom lock to be used during construction. Replace with a passage set after floor has been completed.

HW-5A

Each Door to Have:

RATED

	Hinges	QUANTITY & TYPE AS REQUIRED
1	Storeroom Lock	Best 93K7-D-15C
1	Closer	C02021 with stop
1	Mop Plate	J103
1	Set Self-Adhesive Seals	R0Y154

HW-5B

THIS SET NOT USED.

HW-5C

Each Door to Have:

NON-RATED

	Hinges	QUANTITY & TYPE AS REQUIRED
1	Storeroom Lock	Best 93K7-D-15C
1	Closer	C02011/C02021
1	Kick Plate	J102
1	Wall Stop	L02251 Concave
3	Silencers	L03011

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HW-5D

Each Door to Have:

NON-RATED

	Hinges	QUANTITY & TYPE AS REQUIRED
1	Storeroom Lock	Best 93K7-D x 15C
1	Mop Plate ONLY)	J102 (@ STORAGE, EVM, & HAC ROOMS
1	Overhead Stop	C02541
3	Silencers	L03011

HW-5E

THIS SET NOT USED.

HW-5F

THIS SET NOT USED.

HW-5G

Each Door to Have:

NON-RATED

	Hinges	QUANTITY & TYPE AS REQUIRED
1	Storeroom Lock	Best 93K7-D x 15C
1	Kick Plate	J102
1	Floor Stop	L02121 x 3 FASTENERS
3	Silencers	L03011

HW-5H

THIS SET NOT USED.

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<u>Each Door to Have:</u>	<u>HW-5J</u>	<u>RATED</u>
Hinges	QUANTITY & TYPE AS REQUIRED	
1 Storeroom Lock	Best 93K7-D-15C	
1 Closer	C02011/C02021	
1 Kick Plate	J102	
1 Floor Stop	L02151 CONCAVE	
1 Sets Self-Adhesive Seals	R0Y154	
	<u>HW-5K</u>	
THIS SET NOT USED.		
	<u>HW-5L</u>	
THIS SET NOT USED.		
	<u>HW-6</u>	
THIS SET NOT USED.		
	<u>HW-6A</u>	
THIS SET NOT USED.		
	<u>HW-6B</u>	
THIS SET NOT USED.		
	<u>HW-6C</u>	
THIS SET NOT USED.		
	<u>HW-6D</u>	
THIS SET NOT USED.		
	<u>HW-6E</u>	
THIS SET NOT USED.		

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HW-6F

THIS SET NOT USED.

HW-6G

THIS SET NOT USED.

HW-7

THIS SET NOT USED.

HW-7A

THIS SET NOT USED.

HW-7B

THIS SET NOT USED.

**INTERIOR PAIRS OF DOORS**

HW-8

THIS SET NOT USED.

HW-8A

THIS SET NOT USED.

HW-8B

THIS SET NOT USED.

HW-8C

THIS SET NOT USED.

HW-8D

THIS SET NOT USED.

HW-8E

THIS SET NOT USED.

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HW-8F

THIS SET NOT USED.

HW-9

Each Pair to Have:

NON-RATED

Hinges	QUANTITY & TYPE AS REQUIRED
2 Flush Bolts	L04081
1 Dustproof Strike	L04021
1 Storeroom Lock	Best 93K7-D-15C
1 Wall Stop	L02151
2 Silencers	L03011

HW-10

THIS SET NOT USED.

HW-10A

THIS SET NOT USED.

HW-10B

THIS SET NOT USED.

HW-10C

THIS SET NOT USED.

HW-10D

THIS SET NOT USED.

HW-10E

THIS SET NOT USED.

HW-10F

THIS SET NOT USED.

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HW-10G

THIS SET NOT USED.

HW-10H

THIS SET NOT USED.

HW-10J

THIS SET NOT USED.

HW-10K

THIS SET NOT USED.

HW-10L

THIS SET NOT USED.

HW-10M

THIS SET NOT USED.

HW-11

THIS SET NOT USED.

HW-11A

THIS SET NOT USED.

HW-11B

THIS SET NOT USED.

HW-11C

THIS SET NOT USED.

HW-12

THIS SET NOT USED.

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HW-12A

THIS SET NOT USED.

HW-12B

THIS SET NOT USED.

HW-12C

THIS SET NOT USED.

HW-12D

THIS SET NOT USED.

HW-12E

Each Pair to Have:

RATED

	Hinges	QUANTITY & TYPE AS REQUIRED
2	Push Plates	Trimco 1001-3
1	Set Meeting Stile Astragals	Anemostat DE-FMA or approved equal
2	Closers	C02021
4	Kick Plates	J102
2	Magnetic Holders	(by electrical section)
1	Set Self-Adhesive Seals	R0Y154

HW-12F

Each Pair to Have:

NON-RATED

	Hinges	QUANTITY & TYPE AS REQUIRED
2	Exit Devices	Precision 2201LBR or approve equal
2	Closers	C02021 with HO
4	Kick Plates	J102
2	Wall Stops	L02251 Concave
2	Silencers	L03011
1	Set Meeting Stile Astragals	Anemostat DE-FMA or approved equal

HW-12G

THIS SET NOT USED.

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HW-12H

THIS SET NOT USED.

HW-12J

THIS SET NOT USED.

HW-13

Each Door to Have:

NON-RATED

1 set Sliding Door Hardware	Coburn Flat Track
2 Recessed Pulls	Trimco 1061 x Us26D

HW-14

THIS SET NOT USED.

**EXTERIOR SINGLE DOORS**

HW-E1 through HW -E5

THESE SETS NOT USED.

**EXTERIOR PAIRS OF DOORS**

HW-E6 THROUGH E10

THESE SETS NOT USED.

**EXTERIOR SINGLE GATES**

HW-G1 THROUGH HW -G10

THESE SETS NOT USED.

**RESIDENTIAL UNIT SINGLE DOORS**

HW-R1 THROUGH HW-R7A

THESE SETS NOT USED.



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INTERIOR SINGLE SECURITY DOORS

HW-SH-1

Each Door to Have:

NON-RATED

Hinges	QUANTITY & TYPE AS REQUIRED
1 Transfer Hinge	4 WIRE TYPE AS REQUIRED
1 Electric Lockset	Best 45H7-D-EL x 15H 24VDC
1 Closer	C02011/C02021
1 Overhead Stop	C01541-ADJUSTABLE
1 Kick Plate	J102
1 Mop Plate	J103
1 On/Off Switch	Deltrex 130-RML92E
1 Emergency Buttons	Deltrex 131-M92E
1 Power Supply	Deltrex 552RCM2-ERI (one per toilet)
1 set Sound Seals	Zero 870A jambs/head (or approved equal)
1 Door Bottom	Zero 367A (or approved equal
Signage	(by architect)

120VAC POWER, CONDUIT, AND WIRING BY DIVISION 26.

Operation: During normal operation both doors are unlocked to allow access to the space. Pushing on/off switch locks both outside levers. To exit, push on/off switch or turn inside lever, which will unlock both outside levers. Emergency buttons unlock system automatically.

HW-SH-1A

Each Door to Have:

NON-RATED

Hinges	QUANTITY & TYPE AS REQUIRED
1 Transfer Hinge	4 WIRE TYPE AS REQUIRED
1 Electric Lockset	Best 45H7-D-EL x 15H 24VDC
1 Closer	C02011/C02021
1 Wall Bumper	C02251
1 Kick Plate	J102
1 Mop Plate	J103
1 On/Off Switch	Deltrex 130-RML92E
1 Emergency Button	Deltrex 131-M92E
1 Power Supply	Deltrex 552RCM2-ERI (one per toilet)
1 set Sound Seals	Zero 870A jambs/head (or approved equal)
1 Door Bottom	Zero 367A (or approved equal
Signage	(by architect)

120VAC POWER, CONDUIT, AND WIRING BY DIVISION 26.

Operation: During normal operation both doors are unlocked to allow access to the space. Pushing on/off switch locks both outside levers. To exit, push on/off switch or turn inside lever, which will unlock both outside levers. Emergency buttons unlock system automatically.

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HW-SH-2

THIS SET NOT USED.

HW-SH-3

Each [AC, EL, REX, DPS] Door to Have:

NON-RATED

Hinges	QUANTITY & TYPE AS REQUIRED
1 Transfer Hinge	4-WIRE TYPE AS REQUIRED
1 Electrified Lock	Best 45H7-D-EU x 15H 24VDC
1 Power Supply	REGULATED, FILTERED, 24VDC,
AMPERAGE	AS REQUIRED
1 Closer	C02021 with built in stop
1 Kick Plate	J102
3 Silencers	L03011
1 Alarm Contact	

120VAC POWER, CONDUIT, AND WIRING BY DIVISION 26.

CARD READER BY DIVISION 28.

HW-SH-3A

Each [AC, EL, REX, DPS] Door to Have:

NON-RATED

Hinges	QUANTITY & TYPE AS REQUIRED
1 Transfer Hinge	4-WIRE TYPE AS REQUIRED
1 Electrified Lock	Best 45H7-D-EU x 15H 24VDC
1 Power Supply	REGULATED, FILTERED, 24VDC,
AMPERAGE	AS REQUIRED
1 Closer	C02021
1 Overhead Stop	C01541-ADJUSTABLE
1 Kick Plate	J102
1 set Sound Seals	Zero 870A jambs/head (or approved equal) Conference Room Only
1 Door Bottom	Zero 367A (or approved equal).

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Conference Room Only

1 Alarm Contact  
120VAC POWER, CONDUIT, AND WIRING BY DIVISION 26.  
CARD READER BY DIVISION 28.

HW-SH-3B

Each [PB] Door to Have:

NON-RATED

Hinges	QUANTITY & TYPE AS REQUIRED
1 Push-button Combination Lock	N3 - A156.13 F07 G1 E06
1 Closer	C02011/C02021
1 Kick Plate	J102
1 Mop Plate	J103
1 Floor Stop	L02251 CONCAVE
3 Silencers	L03011

HW-SH-3C

THIS SET NOT USED.

HW-SH-3D

THIS SET NOT USED.

HW-SH-3E

THIS SET NOT USED.

HW-SH-3F

THIS SET NOT USED.

HW-SH-3G

THIS SET NOT USED.

HW-SH-3H

THIS SET NOT USED.

HW-SH-4

THIS SET NOT USED.

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HW-SH-4A

THIS SET NOT USED.

HW-SH-4B

THIS SET NOT USED.

HW-SH-5

THIS HARDWARE SET LEFT INTENTIONALLY BLANK AT THIS TIME.

HW-SH-6

THIS HARDWARE SET LEFT INTENTIONALLY BLANK AT THIS TIME.

**INTERIOR PAIRS OF SECURITY DOORS**

HW-SH-7

THIS HARDWARE SET LEFT INTENTIONALLY BLANK AT THIS TIME.

HW-SH-8

THIS HARDWARE SET LEFT INTENTIONALLY BLANK AT THIS TIME.

HW-SH-9

Each [AC, EL, REX, DPS] Pair to Have:

RATED

Hinges	QUANTITY & TYPE AS REQUIRED
1 Transfer Hinge	4-WIRE TYPE AS REQUIRED
2 Flush Bolts	104081
1 Dust Proof Strike	L04021
1 Electrified Lock	F07 (E01-REX, E06) 24VDC
1 Power Supply	REGULATED, FILTERED, 24VDC,
AMPERAGE	
	AS REQUIRED
1 Closer	C02011/C02021
2 Alarm Contacts	
120VAC POWER, CONDUIT, AND WIRING BY DIVISION 26.	
CARD READER BY DIVISION 28.	

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HW-SH-9A

THIS SET NOT USED.

HW-SH-10

THIS SET NOT USED.

HW-SH-10A

THIS SET NOT USED.

**EXTERIOR SINGLE SECURITY DOORS**

HW-SH-12

THIS SET NOT USED.

**MENTAL HEALTH AREAS**

HW-MH1 THROUGH HW-MH-6A

THESE SETS NOT USED.

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SECTION 08 80 00

GLAZING

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

- A. This section specifies glass, plastic, related glazing materials and accessories. Glazing products specified apply to factory or field glazed items.

**1.2 RELATED WORK**

- A. Factory glazed by manufacturer in following units:
  - 1. Sound resistant doors: Section 08 11 13, HOLLOW METAL DOORS AND FRAMES, and Section 08 14 00, WOOD DOORS.
  - 2. Mirrors: Section 10 28 00, TOILET, BATH, AND LAUNDRY ACCESSORIES.

**1.3 LABELS**

- A. Temporary labels:
  - 1. Provide temporary label on each light of glass identifying manufacturer or brand and glass type, quality and nominal thickness.
  - 2. Temporary labels shall remain intact until glass is approved by Resident Engineer.
- B. Permanent labels:
  - 1. Locate in corner for each pane.
  - 2. Label in accordance with ANSI Z97.1 and SGCC (Safety Glass Certification Council) label requirements.
    - a. Tempered glass.
    - b. Laminated glass or have certificate for panes without permanent label.

**1.4 PERFORMANCE REQUIREMENTS**

- A. Glass Thickness:
  - 1. Test in accordance with ASTM E 1300.
  - 2. Thicknesses listed are minimum. Coordinate thicknesses with framing system manufacturers.
  - 3. Coordinate with Physical Security Design Manual requirements.

**1.5 SUBMITTALS**

- A. In accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Warranty: Submit written guaranty, conforming to General Condition requirements, and to Warranty of Construction Article in this

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Section.

C. Manufacturer's Literature and Data:

1. Glass, each kind required.
2. Elastic compound for metal sash glazing.
3. Glazing cushion.
4. Sealing compound.

D. Preconstruction Adhesion and Compatibility Test Report: Submit glazing sealant manufacturer's test report indicating glazing sealants were tested for adhesion to glass and glazing channel substrates and for compatibility with glass and other glazing materials.

**1.6 DELIVERY, STORAGE AND HANDLING**

A. Delivery: Schedule delivery to coincide with glazing schedules so minimum handling of crates is required. Do not open crates except as required for inspection for shipping damage.

B. Storage: Store cases according to printed instructions on case, in areas least subject to traffic or falling objects. Keep storage area clean and dry.

C. Handling: Unpack cases following printed instructions on case. Stack individual windows on edge leaned slightly against upright supports with separators between each.

D. Protect laminated security glazing units against face and edge damage during entire sequence of fabrication, handling, and delivery to installation location. Provide protective covering on exposed faces of glazing plastics, and mark inside as "INTERIOR FACE" or "PROTECTED FACE":

1. Treat security glazing as fragile merchandise, and packaged and shipped in export wood cases with width end in upright position and blocked together in a mass. Storage and handling shall comply with Manufacturer's directions and as required to prevent edge damage or other damage to glazing resulting from effects of moisture, condensation, temperature changes, direct exposure to sun, other environmental conditions, and contact with chemical solvents.
2. Temporary protections: The glass front and polycarbonate back of glazing shall be temporarily protected with compatible, peelable, heat-resistant film which will be peeled for inspections and



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re-applied and finally removed after doors and windows are installed at destination. Since many adhesives will attack polycarbonate, the film used on exposed polycarbonate surfaces shall be approved and applied by manufacturer.

3. Edge protection: To cushion and protect glass clad, polycarbonate, and Noviflex edges from contamination or foreign matter, the four edges shall be sealed the depth of glazing with continuous standard-thickness Santoprene tape. Alternatively, continuous channel shaped extrusion of Santoprene shall be used, with flanges extending into face sides of glazing.
4. Protect "Constant Temperature" units including every unit where glass sheet is directly laminated to or directly sealed with metal-tube type spacer bar to polycarbonate sheet, from exposures to ambient temperatures outside the range of 16 to 24 C, during the fabricating, handling, shipping, storing, installation, and subsequent protection of glazing.

**1.7 PROJECT CONDITIONS**

- A. Field Measurements: Field measure openings before ordering tempered glass products. Be responsible for proper fit of field measured products.

**1.8 WARRANTY**

- A. Warranty: Conform to terms of "Warranty of Construction", FAR clause 52.246-21, except extend warranty period for the following:
  1. Laminated glass units to remain laminated for 5 years.
  2. Polycarbonate to remain clear and ultraviolet light stabilized for 5 years.

**1.9 APPLICABLE PUBLICATIONS**

- A. Publications listed below form a part of this specification to extent referenced. Publications are referenced in text by basic designation only.
- B. American National Standards Institute (ANSI):
  1. Z97.1-09 Safety Glazing Material Used in Building - Safety Performance Specifications and Methods of Test.
- C. American Society for Testing and Materials (ASTM):
  1. C716-06 Installing Lock-Strip Gaskets and Infill Glazing Materials.
  2. C794-10 Adhesion-in-Peel of Elastomeric Joint Sealants

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3. C864-05 Dense Elastomeric Compression Seal Gaskets, Setting Blocks, and Spacers
4. C920-11 Elastomeric Joint Sealants
5. C1036-06 Flat Glass
6. C1048-12 Heat-Treated Flat Glass-Kind HS, Kind FT Coated and Uncoated Glass.
7. D635-10 Rate of Burning and/or Extent and Time of Burning of Self-Supporting Plastic in a Horizontal Position
8. E84-10 Surface Burning Characteristics of Building Materials
9. E119-10 Standard Test Methods for Fire Test of Building Construction and Material
- D. Commercial Item Description (CID):
  1. A-A-59502 Plastic Sheet, Polycarbonate
- E. Code of Federal Regulations (CFR):
- F. 16 CFR 1201 - Safety Standard for Architectural Glazing Materials; 2010
- G. National Fire Protection Association (NFPA):
  1. 80-13 Fire Doors and Windows.
  2. 252-12 Standard Method of Fire Test of Door Assemblies
  3. 257-12 Standard on Fire Test for Window and Glass Block Assemblies
- H. National Fenestration Rating Council (NFRC)
- I. Safety Glazing Certification Council (SGCC) 2012:
- J. Certified Products Directory (Issued Semi-Annually).
- K. Unified Facilities Criteria (UFC):
  1. 4-010-01-2012 DOD Minimum Antiterrorism Standards for Buildings
- L. Glass Association of North America (GANA):
- M. Glazing Manual (Latest Edition)
- N. Sealant Manual (2009)
- O. American Society of Civil Engineers (ASCE):
  1. ASCE 7-10 Wind Load Provisions

**PART 2 - PRODUCT**

**2.1 GLASS**

- A. Use thickness stated unless specified otherwise in assemblies.
- B. Clear Glass:
  1. ASTM C1036, Type I, Class 1, Quality q3.
  2. Thickness, 6 mm (1/4 inch).

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**2.2 HEAT-TREATED GLASS**

A. Clear Tempered Glass:

1. ASTM C1048, Kind FT, Condition A, Type I, Class 1, Quality q3.
2. Thickness, 6 mm (1/4 inch).

**2.3 LAMINATED GLASS**

- A. Two or more lites of glass bonded with an interlayer material for use in building glazing
- B. Use 1.5 mm (0.060 inch) thick interlayer for:
1. Acoustical glazing.
  2. Heat strengthened or fully tempered glass assemblies.
- C. Use min. 0.75 mm (0.030 inch) thick interlayer for vertical glazing where 1.5 mm (0.060 inch) interlayer is not otherwise shown or required.

**2.4 LAMINATED GLAZING ASSEMBLIES**

A. Clear Glazing:

1. Both panes clear glass ASTM C1036, Type I, Class 1, Quality q3.
2. Thickness: Each pane, as indicated.

B. Clear Tempered Glazing:

1. Both panes ASTM C1048, Kind FT, Condition A, Type I, Class 1, Quality q3.
2. Thickness: Each pane as indicated.

C. Decorative Laminated Glazing:

1. Both panes ASTM C1048, Kind FT, Condition A, Type I, Class 1, Quality q3; etched tempered.
2. Interlayer: 0.060 colored PVB; color as indicated in Finish Legend; linear pattern.
3. Thickness: 1/4-inch each pane; 9/16-inch laminated unit.
4. STC Rating: 39.

**2.5 GLASS CLAD POLYCARBONATE SECURITY GLAZING ASSEMBLY**

- A. Use 1.3 mm (0.050 inch) polyurethane sheeting for interlayer between glass and polycarbonate.
- B. Clear Heat Strengthened Glass Clad Polycarbonate.
1. Use ASTM C1048, Kind HS, Condition A, Type I, Class 1, Quality q3, outer glass panes.
  2. Use clear polycarbonate sheet, 3 mm (1/8 inch) thick core.
  3. Thickness, 11 mm (7/16 inch).

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- C. Clear Tempered Glass Clad Polycarbonate:
  - 1. Use ASTM C1048, Kind FT, Condition A, Type I, Class 1, Quality q3, 3 mm (1/8 inch) thick outer glass panes.
  - 2. Use clear polycarbonate sheet, 3 mm (1/8 inch) thick core.
  - 3. Thickness, 11 mm (7/16 inch).
- D. Maximum Allowable Area: Laminated glazing shall not exceed 1.32 meter square unless glazing has been certified.

**2.6 FIRE RESISTANT GLASS WITHOUT WIRE MESH**

- A. Type 1 (Transparent float glass), Class 1 (Clear).
- B. Fire-protective glass products used to protect against smoke and flames only shall be rated for 20 or 45 minutes as required by local building code and shall be tested in accordance with NFPA 252 (Standard Methods of Fire Tests of Door Assemblies) and NFPA 257 (Standard on Fire Test for Window and Glass Block Assemblies)
- C. Fire-resistive products used to protect against smoke, flame, and the transmission of radiant heat shall be rated for 60, 90, or 120 minutes and shall be tested in accordance with NFPA 252, NFPA 257, and ASTM E119 (Standard Test Methods for Fire Tests of Building Construction and Materials).
- D. Fire-rated glass or glass assembly shall be classified by Underwriters Laboratory (UL), Intertek Testing Services- Warnock Hersey (ITS-WHI) or any other OSHA certified testing laboratory. All glass shall bear a permanent mark of classification in accordance with local building code.
- E. Maximum size is per the manufacturer's test agency listing for doors, transoms, side lights, borrowed lights, and windows.
- F. Where safety glazing is required by local building code, fire-rated glass shall be tested in accordance with CPSC 16 CFR 1201 Category I or II and bear a permanent mark of classification.
  - 1. Category I products are limited to 0.84 m<sup>2</sup> - 9 ft<sup>2</sup> and tested to no less than 203 Nm-150 ft-lbs impact loading.
  - 2. Category II products are greater than 0.84 m<sup>2</sup> - 9 ft<sup>2</sup> and tested to no less than 542 Nm-400 ft-lbs impact loading. Category II products can be used in lieu of Category I products.

**2.7 MAGNETIC MARKER GLASS**

- A. Materials:
  - 1. Mounting Hardware: Minimum of one horizontal Z-Clip per board,

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secured as a wall-mount, in length consistent to the glass width.

2. Sheet Products:

- a. Steel: 0.024-inch-thick steel backer, powder-coated with white paint and adhered to glass.
- b. Face Sheet: 1/4-inch thick tempered, low-iron glass panel with polished edges on all sides, meeting all ANSI Z97.1 specifications.
- c. Coatings: Dual application, zero-VOC, water-based paint, 100 percent opacity with consistent uniformity across entire board.
- d. Adhesive: Permanent silicon acrylic.

**2.8 GLAZING ACCESSORIES**

- A. As required to supplement the accessories provided with the items to be glazed and to provide a complete installation. Ferrous metal accessories exposed in the finished work shall have a finish that will not corrode or stain while in service.
- B. Setting Blocks: ASTM C864:
  - 1. Channel shape; having 6 mm (1/4 inch) internal depth.
  - 2. Shore a hardness of 80 to 90 Durometer.
  - 3. Block lengths: 50 mm (two inches) except 100 to 150 mm (four to six inches) for insulating glass.
  - 4. Block width: Approximately 1.6 mm (1/16 inch) less than the full width of the rabbet.
  - 5. Block thickness: Minimum 4.8 mm (3/16 inch). Thickness sized for rabbet depth as required.
- C. Spacers: ASTM C864:
  - 1. Channel shape having a 6 mm (1/4 inch) internal depth.
  - 2. Flanges not less 2.4 mm (3/32 inch) thick and web 3 mm (1/8 inch) thick.
  - 3. Lengths: One to 25 to 76 mm (one to three inches).
  - 4. Shore a hardness of 40 to 50 Durometer.
- D. Sealing Tapes:
  - 1. Semi-solid polymeric based material exhibiting pressure-sensitive adhesion and withstanding exposure to sunlight, moisture, heat, cold, and aging.
  - 2. Shape, size and degree of softness and strength suitable for use in glazing application to prevent water infiltration.

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- E. Glazing Gaskets: ASTM C864:
  - 1. Firm dense wedge shape for locking in sash.
  - 2. Soft, closed cell with locking key for sash key.
  - 3. Flanges may terminate above the glazing-beads or terminate flush with top of beads.
- F. Glazing Sealants: ASTM C920, silicone neutral cure:
  - 1. Type S.
  - 2. Class 25
  - 3. Grade NS.
  - 4. Shore A hardness of 25 to 30 Durometer.
- G. Neoprene, EPDM, or Vinyl Glazing Gasket: ASTM C864.
  - 1. Channel shape; flanges may terminate above the glazing channel or flush with the top of the channel.
  - 2. Designed for dry glazing.
- H. Color:
  - 1. Color of glazing compounds, gaskets, and sealants used for aluminum color frames shall match color of the finished aluminum and be nonstaining.
  - 2. Color of other glazing compounds, gaskets, and sealants which will be exposed in the finished work and unpainted shall be black, gray, or neutral color.

**PART 3 - EXECUTION**

**3.1 EXAMINATION**

- A. Verification of Conditions:
  - 1. Examine openings for glass and glazing units; determine they are proper size; plumb; square; and level before installation is started.
  - 2. Verify that glazing openings conform with details, dimensions and tolerances indicated on manufacturer's approved shop drawings.
- B. Advise Contractor of conditions which may adversely affect glass and glazing unit installation, prior to commencement of installation: Do not proceed with installation until unsatisfactory conditions have been corrected.
- C. Verify that wash down of adjacent masonry is completed prior to erection of glass and glazing units to prevent damage to glass and glazing units by cleaning materials.

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**3.2 PREPARATION**

- A. For sealant glazing, prepare glazing surfaces in accordance with GANA-02 Sealant Manual.
- B. Determine glazing unit size and edge clearances by measuring the actual unit to receive the glazing.
- C. Shop fabricate and cut glass with smooth, straight edges of full size required by openings to provide GANA recommended edge clearances.
- D. Verify that components used are compatible.
- E. Clean and dry glazing surfaces.
- F. Prime surfaces scheduled to receive sealants, as determined by preconstruction sealant-substrate testing.

**3.3 INSTALLATION - GENERAL**

- A. Install in accordance with GANA-01 Glazing Manual and GANA-02 Sealant Manual unless specified otherwise.
- B. Glaze in accordance with recommendations of glazing and framing manufacturers, and as required to meet the Performance Test Requirements specified in other applicable sections of specifications.
- C. Set glazing without bending, twisting, or forcing of units.
- D. Do not allow glass to rest on or contact any framing member.
- E. Glaze doors and operable sash, in a securely fixed or closed and locked position, until sealant, glazing compound, or putty has thoroughly set.
- F. Tempered Glass: Install with roller distortions in horizontal position unless otherwise directed.
- G. Laminated Glass:
  - 1. Tape edges to seal interlayer and protect from glazing sealants.
  - 2. Do not use putty or glazing compounds.
- H. Fire Resistant Glass:
  - 1. Other fire resistant glass: Glaze in accordance with UL design requirements.

**3.4 INSTALLATION - INTERIOR WET/DRY METHOD (TAPE AND SEALANT)**

- A. Cut glazing tape to length and install against permanent stops, projecting 1.6 mm (1/16 inch) above sight line.
- B. Place setting blocks at 1/4 points with edge block no more than 150 mm (6 inches) from corners.

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- C. Rest glazing on setting blocks and push against tape to ensure full contact at perimeter of pane or unit.
- D. Install removable stops, spacer shims inserted between glazing and applied stops at 600 mm (24 inch) intervals, 6 mm (1/4 inch) below sight line.
- E. Fill gaps between pane and applied stop with sealant to depth equal to bite on glazing, to uniform and level line.
- F. Trim protruding tape edge.

**3.5 REPLACEMENT AND CLEANING**

- A. Clean new glass surfaces removing temporary labels, paint spots, and defacement after approval by Resident Engineer.
- B. Replace cracked, broken, and imperfect glass, or glass which has been installed improperly.
- C. Leave glass, putty, and other setting material in clean, whole, and acceptable condition.

**3.6 PROTECTION**

- A. Protect finished surfaces from damage during erection, and after completion of work. Strippable plastic coatings on colored anodized finish are not acceptable.

**3.7 GLAZING SCHEDULE**

- A. Fire Resistant Glass:
  - 1. Use Fire Resistant Glass without wire mesh unless otherwise indicated
- B. Tempered Glass:
  - 1. Install in full and half glazed doors unless indicated otherwise.
  - 2. Use clear tempered glass on interior side lights and doors unless otherwise indicated or specified.
- C. Laminated Glass: Install as specified in doors, observation windows and interior pane of dual glazed windows where indicated.
  - 1. Provide laminated glass for all windows in Psychiatric Nursing Units, Alcohol Dependency Treatment Nursing Units, Drug Abuse Treatment Nursing Units and Security Bedrooms. Laminated glass shall be 7/16-in thick in locked patient units and security rooms, 5/16-in thick elsewhere.(min. 1.5 mm interlayer).

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SECTION 08 90 00

LOUVERS AND VENTS

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

- A. This section specifies fixed wall louvers.

**1.2 RELATED WORK**

- A. Color of finish: Finish Schedule.

**1.3 SUBMITTALS**

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Shop Drawings:
  - 1. Each type, showing material, finish, size of members, method of assembly, and installation and anchorage details.
- C. Manufacturer's Literature and Data:
  - 1. Each type of louver and vent.

**1.4 APPLICABLE PUBLICATIONS**

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.
- B. American Society for Testing and Materials (ASTM):
  - 1. A1008/A1008M-10 Steel, Sheet, Carbon, Cold Rolled, Structural, and High Strength Low-Alloy with Improved Formability
  - 2. B209/B209M-03(R2007) Aluminum and Aluminum Alloy, Sheet and Plate
  - 3. B221-08 Aluminum and Aluminum Alloy Extruded Bars, Rods, Wire, Shapes, and Tubes
  - 4. B221M-07 Aluminum and Aluminum Alloy Extruded Bars, Rods, Wire Shapes, and Tubes
- C. National Association of Architectural Metal Manufacturers (NAAMM):
  - 1. AMP 500-06 Metal Finishes Manual
- D. National Fire Protection Association (NFPA):
  - 1. 90A-09 Installation of Air Conditioning and Ventilating Systems
- E. American Architectural Manufacturers Association (AAMA):
  - 1. 2605-11 High Performance Organic Coatings on Architectural Extrusions and Panels
- F. Air Movement and Control Association, Inc. (AMCA):
  - 1. 500-L-07 Testing Louvers

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**PART 2 - PRODUCTS**

**2.1 MATERIALS**

- A. Aluminum, Extruded: ASTM B221/B221M.
- B. Aluminum, Plate and Sheet: ASTM B209/B209M.
- C. Fasteners: Fasteners for securing louvers and wall vents to adjoining construction, except as otherwise specified or shown, shall be toggle or expansion bolts, of size and type as required for each specific type of installation and service condition.
  - 1. Where type, size, or spacing of fasteners is not shown or specified, submit shop drawings showing proposed fasteners, and method of installation.
  - 2. Fasteners for louvers, louver frames, and wire guards shall be of stainless steel or aluminum.

**2.2 EXTERIOR WALL LOUVERS**

- A. General:
  - 1. Provide fixed type louvers of size and design shown.
  - 2. Heads, sills and jamb sections shall have formed caulking slots or be designed to retain caulking. Head sections shall have exterior drip lip, and sill sections an integral water stop.
  - 3. Furnish louvers with sill extension or separate sill as shown.
  - 4. Frame shall be mechanically fastened or welded construction with welds dressed smooth and flush.
- B. Performance Characteristics (48 inch by 48 inch louver):
  - 1. Weather louvers shall have a minimum of 7.56 square feet (0.70 sq. m) free area and shall pass 152.40 (500) mm/s (fpm) free area velocity at a pressure drop not exceeding 2.54 (0.10) mm (inch) water gage when tested per AMCA Standard 500-L.
  - 2. Louvers shall bear AMCA certified rating seals for air performance and water penetration ratings.
- C. Aluminum Louvers:
  - 1. General: Frames, blades, sills and mullions (sliding interlocking type); 2 mm (0.081-inch) thick extruded aluminum. Blades shall be storm-resistant type and have reinforcing bosses.
  - 2. Louvers, fixed: Make frame sizes 13 mm (1/2-inch) smaller than openings. Single louvers frames shall not exceed 1700 mm (66 inches) wide. When openings exceed 1700 mm (66 inches), provide twin louvers separated by mullion members.

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**2.3 CLOSURE ANGLES AND CLOSURE PLATES**

- A. Fabricate from 2 mm (0.074-inch) thick stainless steel or aluminum.
- B. Provide continuous closure angles and closure plates on inside head, jams and sill of exterior wall louvers.
- C. Secure angles and plates to louver frames with screws, and to masonry or concrete with fasteners as specified.

**2.4 FINISH**

- A. In accordance with NAAMM Metal Finishes Manual: AMP 500-505
- B. Aluminum Louvers:
  - 1. Organic Finish: AAMA 2605 (Fluorocarbon coating).

**2.5 PROTECTION**

- A. Provide protection for aluminum against galvanic action wherever dissimilar materials are in contact, by painting the contact surfaces of the dissimilar material with a heavy coat of bituminous paint (complete coverage), or by separating the contact surfaces with a performed synthetic rubber tape having pressure sensitive adhesive coating on one side.
- B. Isolate the aluminum from plaster, concrete and masonry by coating aluminum with zinc-chromate primer.
- C. Protect finished surfaces from damage during fabrication, erection, and after completion of the work.

**PART 3 - EXECUTION**

**3.1 INSTALLATION**

- A. Set work accurately, in alignment and where shown. Items shall be plumb, level, free of rack and twist, and set parallel or perpendicular as required to line and plane of surface.
- B. Furnish setting drawings and instructions for installation of anchors and for the positioning of items having anchors to be built into masonry construction. Provide temporary bracing for such items until masonry is set.
- C. Provide anchoring devices and fasteners as shown and as necessary for securing louvers to building construction as specified. Power actuated drive pins may be used, except for removal items and where members would be deformed or substrate damaged by their use.

**3.2 CLEANING AND ADJUSTING**

- A. After installation, all exposed prefinished and plated items and all items fabricated from stainless steel and aluminum shall be cleaned

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as recommended by the manufacturer and protected from damage until  
completion of the project.

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SECTION 09 22 16

NON-STRUCTURAL METAL FRAMING

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This section specifies steel studs wall systems, shaft wall systems, ceiling or soffit suspended or furred framing, wall furring, fasteners, and accessories for the screw attachment of gypsum board, plaster bases or other building boards.

1.2 RELATED WORK

- A. Load bearing framing: Section 05 40 00, COLD-FORMED METAL FRAMING.
- B. Support for wall mounted items: Section 05 50 00, METAL FABRICATIONS.
- C. Ceiling suspension systems for acoustical tile or panels and lay in gypsum board panels: Section 09 51 00, ACOUSTICAL CEILINGS Section 09 29 00, GYPSUM BOARD.

1.3 TERMINOLOGY

- A. Description of terms shall be in accordance with ASTM C754, ASTM C11, ASTM C841 and as specified.
- B. Underside of Structure Overhead: In spaces where steel trusses or bar joists are shown, the underside of structure overhead shall be the underside of the floor or roof construction supported by beams, trusses, or bar joists. In interstitial spaces with walk-on floors the underside of the walk-on floor is the underside of structure overhead.
- C. Thickness of steel specified is the minimum bare (uncoated) steel thickness.

1.4 SUBMITTALS

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Manufacturer's Literature and Data:
  - 1. Studs, runners and accessories.

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2. Hanger inserts.
3. Channels (Rolled steel).
4. Furring channels.
5. Screws, clips and other fasteners.

C. Shop Drawings:

1. Typical ceiling suspension system.
2. Typical metal stud and furring construction system including details around openings and corner details.
3. Typical shaft wall assembly
4. Typical fire rated assembly and column fireproofing showing details of construction same as that used in fire rating test.

D. Test Results: Fire rating test designation, each fire rating required for each assembly.

**1.5 DELIVERY, IDENTIFICATION, HANDLING AND STORAGE**

- A. In accordance with the requirements of ASTM C754.

**1.6 APPLICABLE PUBLICATIONS**

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.

B. American Society For Testing And Materials (ASTM)

1. A123-09 Zinc (Hot-dip Galvanized) Coatings on Iron and Steel Products
2. A653/A653M-09 Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy Coated (Galvannealed) by the Hot-Dip Process
3. A641-09 Zinc-Coated (Galvanized) Carbon Steel Wire
4. C11-10 Terminology Relating to Gypsum and Related Building Materials and Systems
5. C635-07 Manufacture, Performance, and Testing of Metal Suspension System for Acoustical Tile and Lay-in Panel Ceilings
6. C636-06 Installation of Metal Ceiling Suspension

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Systems for Acoustical Tile and Lay-in Panels

7. C645-09 Non-Structural Steel Framing Members
8. C754-09 Installation of Steel Framing Members to Receive Screw-Attached Gypsum Panel Products
9. C841-03 (R2008) Installation of Interior Lathing and Furring
10. C954-07 Steel Drill Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Steel Studs from 0.033 in. (0.84 mm) to 0.112 in. (2.84 mm) in Thickness
11. C1002-07 Steel Self-Piercing Tapping Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Steel Studs
12. E580-09 Application of Ceiling Suspension Systems for Acoustical Tile and Lay-in Panels in Areas Requiring Moderate Seismic Restraint.

**PART 2 - PRODUCTS**

**2.1 PROTECTIVE COATING**

- A. Galvanize steel studs, runners (track), rigid (hat section) furring channels, "Z" shaped furring channels, and resilient furring channels, with coating designation of G-60 minimum, per ASTM 123.

**2.2 STEEL STUDS AND RUNNERS (TRACK)**

- A. ASTM C645, modified for thickness specified and sizes as shown.
  1. Use ASTM A525 steel, 0.8 mm (0.0329-inch) thick bare metal (33 mil).
  2. Runners same thickness as studs.
- B. Provide not less than two cutouts in web of each stud, approximately 300 mm (12 inches) from each end, and intermediate cutouts on approximately 600 mm (24-inch) centers.
- C. Doubled studs for openings and studs for supporting concrete backer-board.
- D. Studs 3600 mm (12 feet) or less in length shall be in one piece.

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E. Shaft Wall Framing:

1. Conform to rated wall construction.
2. C-H Studs.
3. E Studs.
4. J Runners.
5. Steel Jamb-Strut.

**2.3 FURRING CHANNELS**

A. Rigid furring channels (hat shape): ASTM C645.

B. Resilient furring channels:

1. Not less than 0.45 mm (0.0179-inch) thick bare metal.
2. Semi-hat shape, only one flange for anchorage with channel web leg slotted on anchorage side, channel web leg on other side stiffens fastener surface but shall not contact anchorage surface other channel leg is attached to.

C. "Z" Furring Channels:

1. Not less than 0.45 mm (0.0179-inch)-thick bare metal, with 32 mm (1-1/4 inch) and 19 mm (3/4-inch) flanges.
2. Web furring depth to suit thickness of insulation with slotted perforations.

D. Rolled Steel Channels: ASTM C754, cold rolled; or, ASTM C841, cold rolled.

**2.4 FASTENERS, CLIPS, AND OTHER METAL ACCESSORIES**

A. ASTM C754, except as otherwise specified.

B. For fire rated construction: Type and size same as used in fire rating test.

C. Fasteners for steel studs thicker than 0.84 mm (0.033-inch) thick. Use ASTM C954 steel drill screws of size and type recommended by the manufacturer of the material being fastened.

D. Clips: ASTM C841 (paragraph 6.11), manufacturer's standard items. Clips used in lieu of tie wire shall have holding power equivalent to that provided by the tie wire for the specific application.



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E. Concrete ceiling hanger inserts (anchorage for hanger wire and hanger straps): Steel, zinc-coated (galvanized), manufacturers standard items, designed to support twice the hanger loads imposed and the type of hanger used.

F. Tie Wire and Hanger Wire:

1. ASTM A641, soft temper, Class 1 coating.
2. Gage (diameter) as specified in ASTM C754 or ASTM C841.

G. Attachments for Wall Furring:

1. Manufacturers standard items fabricated from zinc-coated (galvanized) steel sheet.
2. For concrete or masonry walls: Metal slots with adjustable inserts or adjustable wall furring brackets. Spacers may be fabricated from 1 mm (0.0396-inch) thick galvanized steel with corrugated edges.

**2.5 SUSPENDED CEILING SYSTEM FOR GYPSUM BOARD (OPTION)**

- A. Conform to ASTM C635, heavy duty, with not less than 35 mm (1-3/8 inch) wide knurled capped flange face designed for screw attachment of gypsum board.
- B. Wall track channel with 35 mm (1-3/8 inch) wide flange.

**PART 3 - EXECUTION**

**3.1 INSTALLATION CRITERIA**

- A. Where fire rated construction is required for walls, partitions, columns, beams and floor-ceiling assemblies, the construction shall be same as that used in fire rating test.
- B. Construction requirements for fire rated assemblies and materials shall be as shown and specified, the provisions of the Scope paragraph (1.2) of ASTM C754 and ASTM C841 regarding details of construction shall not apply.

**3.2 INSTALLING STUDS**

- A. Install studs in accordance with ASTM C754, except as otherwise shown or specified.

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- B. Space studs not more than 610 mm (24 inches) on center.
- C. Cut studs 6 mm to 9 mm (1/4 to 3/8-inch) less than floor to underside of structure overhead when extended to underside of structure overhead.
- D. Where studs are shown to terminate above suspended ceilings, provide bracing as shown or extend studs to underside of structure overhead.
- E. Extend studs to underside of structure overhead for fire, rated partitions, smoke partitions, shafts, and sound rated partitions .
- F. At existing plaster ceilings and where shown, studs may terminate at ceiling as shown.
- G. Openings:
  - 1. Frame jambs of openings in stud partitions and furring with two studs placed back to back or as shown.
  - 2. Fasten back to back studs together with 9 mm (3/8-inch) long Type S pan head screws at not less than 600 mm (two feet) on center, staggered along webs.
  - 3. Studs fastened flange to flange shall have splice plates on both sides approximately 50 X 75 mm (2 by 3 inches) screwed to each stud with two screws in each stud. Locate splice plates at 600 mm (24 inches) on center between runner tracks.
- H. Fastening Studs:
  - 1. Fasten studs located adjacent to partition intersections, corners and studs at jambs of openings to flange of runner tracks with two screws through each end of each stud and flange of runner.
  - 2. Do not fasten studs to top runner track when studs extend to underside of structure overhead.
- I. Chase Wall Partitions:
  - 1. Locate cross braces for chase wall partitions to permit the installation of pipes, conduits, carriers and similar items.
  - 2. Use studs or runners as cross bracing not less than 63 mm (2-1/2 inches wide).
- J. Form building seismic or expansion joints with double studs back to back spaced 75 mm (three inches) apart plus the width of the seismic

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or expansion joint.

K. Form control joint, with double studs spaced 13 mm (1/2-inch) apart.

**3.3 INSTALLING WALL FURRING FOR FINISH APPLIED TO ONE SIDE ONLY**

A. In accordance with ASTM C754, or ASTM C841 except as otherwise specified or shown.

B. Wall furring-Stud System:

1. Framed with 63 mm (2-1/2 inch) or narrower studs, 600 mm (24 inches) on center.
2. Brace as specified in ASTM C754 for Wall Furring-Stud System or brace with sections or runners or studs placed horizontally at not less than three foot vertical intervals on side without finish.
3. Securely fasten braces to each stud with two Type S pan head screws at each bearing.

C. Direct attachment to masonry or concrete; rigid channels or "Z" channels:

1. Install rigid (hat section) furring channels at 600 mm (24 inches) on center, horizontally or vertically.
2. Install "Z" furring channels vertically spaced not more than 600 mm (24 inches) on center.
3. At corners where rigid furring channels are positioned horizontally, provide mitered joints in furring channels.
4. Ends of spliced furring channels shall be nested not less than 200 mm (8 inches).
5. Fasten furring channels to walls with power-actuated drive pins or hardened steel concrete nails. Where channels are spliced, provide two fasteners in each flange.
6. Locate furring channels at interior and exterior corners in accordance with wall finish material manufacturers printed erection instructions. Locate "Z" channels within 100 mm (4 inches) of corner.

D. Installing Wall Furring-Bracket System: Space furring channels not more than 400 mm (16 inches) on center.

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**3.4 INSTALLING SUPPORTS REQUIRED BY OTHER TRADES**

- A. Provide for attachment and support of electrical outlets, plumbing, laboratory or heating fixtures, recessed type plumbing fixture accessories, access panel frames, wall bumpers, wood seats, toilet stall partitions, dressing booth partitions, urinal screens, chalkboards, tackboards, wall-hung casework, handrail brackets, recessed fire extinguisher cabinets and other items like auto door buttons and auto door operators supported by stud construction.
- B. Provide additional studs where required. Install metal backing plates, or special metal shapes as required, securely fastened to metal studs.

**3.5 INSTALLING SHAFT WALL SYSTEM**

- A. Conform to UL Design No. U438 for two-hour fire rating. Provide one hour fire rating Shaft wall at locations indicated on Drawings.
- B. Position J runners at floor and ceiling with the short leg toward finish side of wall. Securely attach runners to structural supports at both ends and 600 mm (24 inches) on center.
- C. After liner panels have been erected, cut C-H studs and E studs, from 9 mm (3/8-inch) to not more than 13 mm (1/2-inch) less than floor-to-ceiling height. Install C-H studs between liner panels with liner panels inserted in the groove.
- D. Install full-length steel E studs over shaft wall line at intersections, corners, hinged door jambs, columns, and both sides of closure panels.
- E. Suitably frame all openings to maintain structural support for wall:
  - 1. Provide necessary liner fillers and shims to conform to label frame requirements.
  - 2. Frame openings cut within a liner panel with E studs around perimeter.
  - 3. Frame openings with vertical E studs at jambs, horizontal J runner at head and sill.

**3.6 INSTALLING FURRED AND SUSPENDED CEILINGS OR SOFFITS**

- A. Install furred and suspended ceilings or soffits in accordance with

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ASTM C754 or ASTM C841 except as otherwise specified or shown for screw attached gypsum board ceilings and for plaster ceilings or soffits.

1. Space framing at 400 mm (16-inch) centers for metal lath anchorage.
2. Space framing at 600 mm (24-inch) centers for gypsum board anchorage.

**B. Concrete slabs on steel decking composite construction:**

1. Use pull down tabs when available.
2. Use fasteners when direct attachment to structural framing can not be accomplished.

**C. Where bar joists or beams are more than 1200 mm (48 inches) apart, provide intermediate hangers so that spacing between supports does not exceed 1200 mm (48 inches). Use clips, bolts, or wire ties for direct attachment to steel framing.**

**D. Existing concrete construction exposed or concrete on steel decking:**

1. Use either eye pin, threaded studs or drive pins for type of hanger attachment required.
2. Install fasteners at approximate mid height of concrete beams or joists. Do not install in bottom of beams or joists.

**E. Steel decking without concrete topping:**

1. Do not fasten to steel decking 0.76 mm (0.0299-inch) or thinner.
2. Toggle bolt to decking 0.9 mm (0.0359-inch) or thicker only where anchorage to steel framing is not possible.

**F. Installing suspended ceiling system for gypsum board (ASTM C635 Option):**

1. Install only for ceilings to receive screw attached gypsum board.
2. Install in accordance with ASTM C636.
  - a. Install main runners spaced 1200 mm (48 inches) on center.
  - b. Install 1200 mm (four foot) tees not over 600 mm (24 inches) on center; locate for edge support of gypsum board.
  - c. Install wall track channel at perimeter.

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**G. Installing Ceiling Bracing System:**

1. Construct bracing of 38 mm (1-1/2 inch) channels for lengths up to 2400 mm (8 feet) and 50 mm (2 inch) channels for lengths over 2400 mm (8 feet) with ends bent to form surfaces for anchorage to carrying channels and over head construction. Lap channels not less than 600 mm (2 feet) at midpoint back to back. Screw or bolt lap together with two fasteners.
2. Install bracing at an approximate 45 degree angle to carrying channels and structure overhead; secure as specified to structure overhead with two fasteners and to carrying channels with two fasteners or wire ties.
3. Brace suspended ceiling or soffit framing in seismic areas in accordance with ASTM E580.

**3.7 TOLERANCES**

- A. Fastening surface for application of subsequent materials shall not vary more than 3 mm (1/8-inch) from the layout line.
- B. Plumb and align vertical members within 3 mm (1/8-inch.)
- C. Level or align ceilings within 3 mm (1/8-inch.)

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SECTION 09 29 00

GYPSUM BOARD

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This section specifies installation and finishing of gypsum board.

1.2 RELATED WORK

- A. Installation of steel framing members for walls, partitions, furring, soffits, and ceilings: Section 05 40 00, COLD-FORMED METAL FRAMING, and Section 09 22 16, NON-STRUCTURAL METAL FRAMING.
- B. Acoustical Sealants: Section 07 92 00, JOINT SEALANTS.

1.3 TERMINOLOGY

- A. Definitions and description of terms shall be in accordance with ASTM C11, C840, and as specified.
- B. Underside of Structure Overhead: In spaces where steel trusses or bar joists are shown, the underside of structure overhead shall be the underside of the floor or roof construction supported by the trusses or bar joists.
- C. "Yoked": Gypsum board cut out for opening with no joint at the opening (along door jamb or above the door).

1.4 SUBMITTALS

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Manufacturer's Literature and Data:
  - 1. Cornerbead and edge trim.
  - 2. Finishing materials.
  - 3. Laminating adhesive.
  - 4. Gypsum board, each type.
- C. Shop Drawings:
  - 1. Typical gypsum board installation, showing corner details, edge

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trim details and the like.

2. Typical sound rated assembly, showing treatment at perimeter of partitions and penetrations at gypsum board.
3. Typical shaft wall assembly.
4. Typical fire rated assembly and column fireproofing, indicating details of construction same as that used in fire rating test.

**1.5 DELIVERY, IDENTIFICATION, HANDLING AND STORAGE**

- A. In accordance with the requirements of ASTM C840.

**1.6 ENVIRONMENTAL CONDITIONS**

- A. In accordance with the requirements of ASTM C840.

**1.7 APPLICABLE PUBLICATIONS**

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.
- B. American Society for Testing And Materials (ASTM):
  1. C11-08 Terminology Relating to Gypsum and Related Building Materials and Systems
  2. C475-02 Joint Compound and Joint Tape for Finishing Gypsum Board
  3. C840-08 Application and Finishing of Gypsum Board
  4. C919-08 Sealants in Acoustical Applications
  5. C954-07 Steel Drill Screws for the Application of Gypsum Board or Metal Plaster Bases to Steel Stud from 0.033 in. (0.84mm) to 0.112 in. (2.84mm) in thickness
  6. C1002-07 Steel Self-Piercing Tapping Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Steel Studs
  7. C1047-05 Accessories for Gypsum Wallboard and Gypsum Veneer Base
  8. C1396-06 Gypsum Board
  9. E84-08 Surface Burning Characteristics of Building Materials



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C. Underwriters Laboratories Inc. (UL):

1. Latest Edition Fire Resistance Directory

D. Inchcape Testing Services (ITS):

1. Latest Editions                      Certification Listings

**PART 2 - PRODUCTS**

**2.1 GYPSUM BOARD**

A. Gypsum Board: ASTM C1396, Type X, 16 mm (5/8 inch) thick unless shown otherwise. Shall contain a minimum of 20 percent recycled gypsum.

B. Coreboard or Shaft Wall Liner Panels.

1. ASTM C1396, Type X.

2. Coreboard for shaft walls 300, 400, 600 mm (12, 16, or 24 inches) wide by required lengths 25 mm (one inch) thick with paper faces treated to resist moisture.

C. Water Resistant Gypsum Backing Board: ASTM C620, Type X, 16 mm (5/8 inch) thick.

D. Gypsum cores shall contain a minimum of 95 percent post industrial recycled gypsum content. Paper facings shall contain 100 percent post-consumer recycled paper content.

**2.2 ACCESSORIES**

A. ASTM C1047, except form of 0.39 mm (0.015 inch) thick zinc coated steel sheet or rigid PVC plastic.

B. Flanges not less than 22 mm (7/8 inch) wide with punchouts or deformations as required to provide compound bond.

**2.3 FASTENERS**

A. ASTM C1002 and ASTM C840, except as otherwise specified.

B. ASTM C954, for steel studs thicker than 0.04 mm (0.33 inch).

C. Select screws of size and type recommended by the manufacturer of the material being fastened.

D. For fire rated construction, type and size same as used in fire rating test.

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- E. Clips: Zinc-coated (galvanized) steel; gypsum board manufacturer's standard items.

**2.4 FINISHING MATERIALS AND LAMINATING ADHESIVE**

- A. ASTM C475 and ASTM C840. Free of antifreeze, vinyl adhesives, preservatives, biocides and other VOC. Adhesive shall contain a maximum VOC content of 50 g/l.

**PART 3 - EXECUTION**

**3.1 GYPSUM BOARD HEIGHTS**

- A. Extend all layers of gypsum board from floor to underside of structure overhead on following partitions and furring:
  - 1. Two sides of partitions:
    - a. Fire rated partitions.
    - b. Smoke partitions.
    - c. Sound rated partitions.
    - d. Full height partitions shown (FHP).
    - e. Corridor partitions.
  - 2. One side of partitions or furring:
    - a. Inside of exterior wall furring or stud construction.
    - b. Room side of room without suspended ceilings.
    - c. Furring for pipes and duct shafts, except where fire rated shaft wall construction is shown.
  - 3. Extend all layers of gypsum board construction used for fireproofing of columns from floor to underside of structure overhead, unless shown otherwise.
- B. In locations other than those specified, extend gypsum board from floor to heights as follows:
  - 1. Not less than 100 mm (4 inches) above suspended acoustical ceilings.
  - 2. At ceiling of suspended gypsum board ceilings.
  - 3. At existing ceilings.

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**3.2 INSTALLING GYPSUM BOARD**

- A. Coordinate installation of gypsum board with other trades and related work.
- B. Install gypsum board in accordance with ASTM C840, except as otherwise specified.
- C. Moisture and Mold-Resistant Assemblies: Provide and install moisture and mold-resistant glass mat gypsum wallboard products with moisture-resistant surfaces complying with ASTM C1658 where shown and in locations which might be subject to moisture exposure during construction.
- D. Use gypsum boards in maximum practical lengths to minimize number of end joints.
- E. Bring gypsum board into contact, but do not force into place.
- F. Ceilings:
  - 1. For single-ply construction, use perpendicular application.
  - 2. For two-ply assemblies:
    - a. Use perpendicular application.
    - b. Apply face ply of gypsum board so that joints of face ply do not occur at joints of base ply with joints over framing members.
- G. Walls (Except Shaft Walls):
  - 1. When gypsum board is installed parallel to framing members, space fasteners 300 mm (12 inches) on center in field of the board, and 200 mm (8 inches) on center along edges.
  - 2. When gypsum board is installed perpendicular to framing members, space fasteners 300 mm (12 inches) on center in field and along edges.
  - 3. Stagger screws on abutting edges or ends.
  - 4. For single-ply construction, apply gypsum board with long dimension either parallel or perpendicular to framing members as required to minimize number of joints except gypsum board shall be applied vertically over "Z" furring channels.

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5. For two-ply gypsum board assemblies, apply base ply of gypsum board to assure minimum number of joints in face layer. Apply face ply of wallboard to base ply so that joints of face ply do not occur at joints of base ply with joints over framing members.
6. For three-ply gypsum board assemblies, apply plies in same manner as for two-ply assemblies, except that heads of fasteners need only be driven flush with surface for first and second plies. Apply third ply of wallboard in same manner as second ply of two-ply assembly, except use fasteners of sufficient length enough to have the same penetration into framing members as required for two-ply assemblies.
7. No offset in exposed face of walls and partitions will be permitted because of single-ply and two-ply or three-ply application requirements.
8. Installing Two Layer Assembly Over Sound Deadening Board:
  - a. Apply face layer of wallboard vertically with joints staggered from joints in sound deadening board over framing members.
  - b. Fasten face layer with screw, of sufficient length to secure to framing, spaced 300 mm (12 inches) on center around perimeter, and 400 mm (16 inches) on center in the field.
9. Control Joints ASTM C840 and as follows:
  - a. Locate at both side jambs of openings if gypsum board is not "yoked". Use one system throughout.
  - b. Not required for wall lengths less than 9000 mm (30 feet).
  - c. Extend control joints the full height of the wall or length of soffit/ceiling membrane.
- H. Acoustical or Sound Rated Partitions, Fire and Smoke Partitions:
  1. Cut gypsum board for a space approximately 3 mm to 6 mm (1/8 to 1/4 inch) wide around partition perimeter.
  2. Coordinate for application of caulking or sealants to space prior to taping and finishing.
  3. For sound rated partitions, use sealing compound (ASTM C919) to fill the annular spaces between all receptacle boxes and the

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partition finish material through which the boxes protrude to seal all holes and/or openings on the back and sides of the boxes. STC minimum values as shown.

**I. Electrical and Telecommunications Boxes:**

1. Seal annular spaces between electrical and telecommunications receptacle boxes and gypsum board partitions.

**J. Accessories:**

1. Set accessories plumb, level and true to line, neatly mitered at corners and intersections, and securely attach to supporting surfaces as specified.
2. Install in one piece, without the limits of the longest commercially available lengths.

**3. Corner Beads:**

- a. Install at all vertical and horizontal external corners and where shown.
- b. Use screws only. Do not use crimping tool.

**4. Edge Trim (casings Beads):**

- a. At both sides of expansion and control joints unless shown otherwise.
- b. Where gypsum board terminates against dissimilar materials and at perimeter of openings, except where covered by flanges, casings or permanently built-in equipment.
- c. Where gypsum board surfaces of non-load bearing assemblies abut load bearing members.
- d. Where shown.

**3.3 CAVITY SHAFT WALL**

- A. Coordinate assembly with Section 09 22 16, NON-STRUCTURAL METAL FRAMING, for erection of framing and gypsum board.
- B. Conform to UL Design No. U438 or FM WALL CONSTRUCTION 12-2/HR (Nonbearing for two-hour fire rating. Conform to FM WALL CONSTRUCTION 25-1/HR (Non-loadbearing) for one-hour fire rating where shown.

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- C. Cut coreboard (liner) panels 25 mm (one inch) less than floor-to-ceiling height, and erect vertically between J-runners on shaft side.
  - 1. Where shaft walls exceed 4300 mm (14 feet) in height, position panel end joints within upper and lower third points of wall.
  - 2. Stagger joints top and bottom in adjacent panels.
  - 3. After erection of J-struts of opening frames, fasten panels to J-struts with screws of sufficient length to secure to framing staggered from those in base, spaced 300 mm (12 inches) on center.

D. Gypsum Board:

- 1. Two hour wall:
  - a. Erect base layer (backing board) vertically on finish side of wall with end joints staggered. Fasten base layer panels to studs with 25 mm (one inch) long screws, spaced 600 mm (24 inches) on center.
  - b. Use laminating adhesive between plies in accordance with UL or FM if required by fire test.
  - c. Apply face layer of gypsum board required by fire test vertically over base layer with joints staggered and attach with screws of sufficient length to secure to framing staggered from those in base, spaced 300 mm (12 inches) on center.
- 2. One hour wall with one layer on finish side of wall: Apply face layer of gypsum board vertically. Attach to studs with screws of sufficient length to secure to framing, spaced 300 mm (12 inches) on center in field and along edges.
- 3. Where coreboard is covered with face layer of gypsum board, stagger joints of face layer from those in the coreboard base.

- E. Treat joints, corners, and fasteners in face layer as specified for finishing of gypsum board.

**3.4 FINISHING OF GYPSUM BOARD**

- A. Finish joints, edges, corners, and fastener heads in accordance with ASTM C840. Use Level 4 finish for all finished areas open to public view.

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- B. Before proceeding with installation of finishing materials, assure the following:
  - 1. Gypsum board is fastened and held close to framing or furring.
  - 2. Fastening heads in gypsum board are slightly below surface in dimple formed by driving tool.
- C. Finish joints, fasteners, and all openings, including openings around penetrations, on that part of the gypsum board extending above suspended ceilings to seal surface of non decorated smoke barrier, fire rated and sound rated gypsum board construction. After the installation of hanger rods, hanger wires, supports, equipment, conduits, piping and similar work, seal remaining openings and maintain the integrity of the construction/ Sanding is not required of non decorated surfaces.

**3.5 REPAIRS**

- A. After taping and finishing has been completed, and before decoration, repair all damaged and defective work, including nondecorated surfaces.
- B. Patch holes or openings 13 mm (1/2 inch) or less in diameter, or equivalent size, with a setting type finishing compound or patching plaster.
- C. Repair holes or openings over 13 mm (1/2 inch) diameter, or equivalent size, with 16 mm (5/8 inch) thick gypsum board secured in such a manner as to provide solid substrate equivalent to undamaged surface.
- D. Tape and refinish scratched, abraded or damaged finish surfaces including cracks and joints in non decorated surface to provide smoke tight construction, fire protection equivalent to the fire rated construction, and STC equivalent to the sound rated construction.

**3.6 UNACCESSIBLE CEILINGS**

- A. At Mental Health and Behavioral Nursing Units, areas accessible to patients and not continuously observable by staff (e.g., patient bedrooms, day rooms), ceilings should be a solid material such as gypsum board. This will limit patient access. Access doors are needed to access electrical and mechanical equipment above the ceiling. These

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doors should be locked to prevent unauthorized access and secured to  
ceiling using tamper resistant fasteners.

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SECTION 09 30 13

CERAMIC/PORCELAIN TILING

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This section specifies ceramic and porcelain tile, waterproofing membranes for thin-set applications, and tile backer board.

1.2 RELATED WORK

- A. Sealing of joints where specified: Section 07 92 00, JOINT SEALANTS.
- B. Color, texture and pattern of field tile and trim shapes, size of field tile, trim shapes, and color of grout specified: Finish Schedule.
- C. Metal and resilient edge strips at joints with new resilient flooring, and carpeting: Section 09 65 19, RESILIENT TILE FLOORING and Section 09 68 00, CARPETING.

1.3 SUBMITTALS

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Samples:
  - 1. Base tile, each type, each color, each size.
  - 2. Mosaic floor tile panels, 225 mm by 225 mm (9 inches by 9 inches), each type, color, size and pattern.
  - 3. Porcelain tile, each type, color, patterns and size.
  - 4. Wall (or wainscot) tile, each color, size and pattern.
  - 5. Trim shapes, bullnose cap and cove including bullnose cap and base pieces at internal and external corners of vertical surfaces, each type, color, and size.
- C. Product Data:
  - 1. Ceramic and porcelain tile, marked to show each type, size, and shape required.
  - 2. Chemical resistant mortar and grout (Epoxy).

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3. Cementitious backer unit.
4. Dry-set Portland cement mortar and grout.
5. Divider strip.
6. Elastomeric membrane and bond coat.
7. Reinforcing tape.
8. Leveling compound.
9. Latex-Portland cement mortar and grout.
10. Commercial Portland cement grout.
11. Organic adhesive.
12. Slip resistant tile.
13. Waterproofing isolation membrane.
14. Fasteners.

**1.4 DELIVERY AND STORAGE**

- A. Deliver materials in containers with labels legible and intact and grade-seals unbroken.
- B. Store material to prevent damage or contamination.

**1.5 APPLICABLE PUBLICATIONS**

- A. Publications listed below form a part of this specification to the extent referenced. Publications are referenced in text by basic designation only.
- B. American National Standards Institute (ANSI):
  1. A108.1A-11 Installation of Ceramic Tile in the Wet-Set Method with Portland Cement Mortar
  2. A108.1B-11 Installation of Ceramic Tile on a Cured Portland Cement Mortar Setting Bed with dry-Set or latex-Portland Cement Mortar
  3. A108.1C-11 Contractors Option; Installation of Ceramic Tile in the Wet-Set method with Portland Cement Mortar or Installation of Ceramic Tile on a Cured Portland Cement Mortar Setting Bed with Dry-Set or Latex-Portland Cement Mortar

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4. A137.1-08 Ceramic Tile

C. American Society For Testing And Materials (ASTM):

1. A185-07 Steel Welded Wire Fabric, Plain, for Concrete Reinforcing
2. C109/C109M-11 Standard Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 2 inch. or 50-mm Cube Specimens)
3. C348-08 Standard Test Method for Flexural Strength of Hydraulic-Cement Mortars
4. C627-10 Evaluating Ceramic Floor Tile Installation Systems Using the Robinson-Type Floor Tester
5. C954-11 Steel Drill Screws for the Application of Gypsum Board on Metal Plaster Base to Steel Studs from 0.033 in (0.84 mm) to 0.112 in (2.84 mm) in thickness
6. C1002-07 Steel Self-Piercing Tapping Screws for the Application of Panel Products
7. C1027-09 Determining "Visible Abrasion Resistance on Glazed Ceramic Tile"
8. C1028-07 Determining the Static Coefficient of Friction of Ceramic Tile and Other Like Surfaces by the Horizontal Dynamometer Pull Meter Method
9. C1127-09 Standard Guide for Use of High Solids Content, Cold Liquid-Applied Elastomeric Waterproofing Membrane with an Integral Wearing Surface
10. C1178/C1178M-11 Standard Specification for Coated Glass Mat Water-Resistant Gypsum Backing Panel
11. C1325-08 Non-Asbestos Fiber-Mat Reinforced Cementitious Backer Units
12. D4397-10 Standard Specification for Polyethylene Sheeting for Construction, Industrial and Agricultural Applications

D. Tile Council of America, Inc. (TCA):

1. 2007 Handbook for Ceramic Tile Installation

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**PART 2 - PRODUCTS**

**2.1 TILE**

- A. Comply with ANSI A137.1, Standard Grade, except as modified:
  - 1. Inspection procedures listed under the Appendix of ANSI A137.1.
  - 2. Abrasion Resistance Classification:
    - a. Tested in accordance with values listed in Table 1, ASTM C 1027.
    - b. Class IV, 6000 revolutions for remaining areas.
  - 3. Slip Resistant Tile for Floors:
    - a. Coefficient of friction, when tested in accordance with ASTM C1028, required for level of performance:
      - 1) Not less than 0.7 (wet condition) for bathing areas.
    - b. Tile Having Abrasive Grains:
      - 1) Unglazed Ceramic Mosaic Tile: Abrasive grains throughout body of the tile.
    - c. Porcelain Paver Tile: Matte surface finish
  - 4. Mosaic tile may be mounted or joined together by a resinous bonding material along tile edges.
  - 5. Factory Blending: For tile with color variations, within the ranges selected during sample submittals blend tile in the factory and package so tile units taken from one package show the same range in colors as those taken from other packages and match approved samples.
  - 6. Factory-Applied Temporary Protective Coating:
    - a. Protect exposed face surfaces (top surface) of tile against adherence of mortar and grout by pre-coating with a continuous film of petroleum paraffin wax, applied hot.
    - b. Do not coat unexposed tile surfaces.
    - c. Pre-wax tiles set or grouted with furan or epoxy or latex modified mortars.
- B. Unglazed Ceramic Mosaic Tile: Nominal 6 mm (1/4 inch) thick with cushion edges.

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- C. Glazed Wall Tile: Cushion edges, glazing, as specified in Finish Schedule.
- D. Porcelain Paver Tile: Nominal 8 mm (5/16 inch) thick, with cushion edges. Porcelain tile produced by the dust pressed method shall be made of approximately 50% feldspar; the remaining 50% shall be made up of various high-quality light firing ball clays yielding a tile with a water absorption rate of 0.5% or less and a breaking strength of between 390 to 400 pounds.
- E. Trim Shapes:
  - 1. Conform to applicable requirements of adjoining floor and wall tile.
  - 2. Use trim shapes sizes conforming to size of adjoining field wall tile including existing spaces unless detailed or specified otherwise in Finish Schedule.
  - 3. Internal and External Corners:
    - a. Square internal and external corner joints are not acceptable.
    - b. External corners including edges: Use bullnose shapes.
    - c. Internal corners: Use cove shapes.
    - d. Base to floor internal corners: Use special shapes providing integral cove vertical and horizontal joint.
    - e. Base to floor external corners: Use special shapes providing bullnose vertical edge with integral cove horizontal joint. Use stop at bottom of openings having bullnose return to wall.
    - f. Wall top edge internal corners: Use special shapes providing integral cove vertical joint with bullnose top edge.
    - g. Wall top edge external corners: Use special shapes providing bullnose vertical and horizontal joint edge.
    - h. For unglazed ceramic mosaic and glazed wall tile installed in Portland cement mortar setting bed, use cove and bullnose shapes as applicable. When ceramic mosaic wall and base tile is required, use C Series cove and bullnose shapes.
    - i. For unglazed ceramic mosaic and glazed wall tile installed in dry-set Portland cement mortar, latex-Portland cement mortar,

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and organic adhesive (thin set methods), use cove and surface bullnose shapes as applicable.

- j. Provide cove and bullnose shapes saddles, and required to complete tile work.

**2.2 CEMENTITIOUS BACKER UNITS**

- A. Use in showers or wet areas.
- B. ASTM C1325.
- C. Use Cementitious backer units in maximum available lengths.

**2.3 JOINT MATERIALS FOR CEMENTITIOUS BACKER UNITS**

- A. Reinforcing Tape: Vinyl coated woven glass fiber mesh tape, open weave, 50 mm (2 inches) wide. Tape with pressure sensitive adhesive backing will not be permitted.
- B. Tape Embedding Material: Latex-Portland cement mortar complying with ANSI A108.1.
- C. Joint material, including reinforcing tape, and tape embedding material, shall be as specifically recommended by the backer unit manufacturer.

**2.4 FASTENERS**

- A. Screws for Cementitious Backer Units.
  - 1. Standard screws for gypsum board are not acceptable.
  - 2. Minimum 11 mm (7/16 inch) diameter head, corrosion resistant coated, with washers.
  - 3. ASTM C954 for steel 1 mm (0.033 inch) thick.
  - 4. ASTM C1002 for steel framing less than 0.0329 inch thick.
- B. Washers: Galvanized steel, 13 mm (1/2 inch) minimum diameter.

**2.5 GLASS MAT WATER RESISTANT GYPSUM BACKER BOARD**

- A. Confirm to ASTM C1178/C1178M, Optional System for Cementitious Backer Units.

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**2.6 SETTING MATERIALS OR BOND COATS**

- A. Conform to TCA Handbook for Ceramic Tile Installation.
- B. Latex-Portland Cement Mortar: ANSI A108.1.
  - 1. For wall applications, provide non-sagging, latex-Portland cement mortar complying with ANSI A108.1.
  - 2. Prepackaged Dry-Mortar Mix: Factory-prepared mixture of Portland cement; dry, redispersible, ethylene vinyl acetate additive; and other ingredients to which only water needs to be added at Project site.
- C. Waterproofing Isolation Membrane:
  - 1. Sheet System TCA F122-02.
  - 2. Optional System to elastomeric waterproof membrane.
  - 3. Composite sheet consisting of ASTM D5109, Type II, Grade I Chlorinated Polyethylene (CM) sheet reinforced on both sides with a non-woven polyester fiber.
  - 4. Designed for use in wet areas as an isolation and positive waterproofing membranes for thin-set bonding of sheet to substrate and thin-set bonding of ceramic and porcelain tile or marble to sheet. Suited for both horizontal and vertical applications.
  - 5. Conform to the following additional physical properties:

Property	Units	Results	Test Method
Hardness Shore A	Points	70-80	ASTM D2240 (10 Second Reading)
Shrinkage	Percent	5 maximum	ASTM D1204
Brittleness		No crack remains flexible at temperature-37 degrees C (-25 degrees F)	ASTM D2497 13 mm (1/2-inch) Mandrel Bend
Retention of Properties after Heat Aging	Percent of original	80 Tensile 80 Breaking 80 Elongation	ASTM D3045, 90 degrees C (194 degrees F) for 168 hours

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6. Manufacturer's standard sheet size with prefabricated or preformed inside and outside corners.
7. Sheet manufacturer's solvent welding liquid or xylene and edge sealant.

**2.7 GROUTING MATERIALS**

A. White Portland Cement Grout:

1. ANSI A108.1.
2. Use one part white Portland cement to one part white sand passing a number 30 screen.
3. Color additive not permitted.

B. Commercial Portland Cement Grout: ANSI A108.1 color as specified.

C. Latex-Portland Cement Grout: ANSI A108.1 color as specified.

1. Unsanded grout mixture for joints 3.2 mm (1/8 inch) and narrower.
2. Sanded grout mixture for joints 3.2 mm (1/8 inch) and wider.

D. Chemical-Resistant Grout:

1. Epoxy grout, ANSI A108.1.

**2.8 PATCHING AND LEVELING COMPOUND**

A. Portland cement base, polymer-modified, self-leveling compound, manufactured specifically for resurfacing and leveling concrete floors. Products containing gypsum are not acceptable.

B. Shall have minimum following physical properties:

1. Compressive strength - 25 MPa (3500 psig) per ASTM C109/C109M.
2. Flexural strength - 7 MPa (1000 psig) per ASTM C348 (28 day value).
3. Tensile strength - 600 psi per ANSI 118.7.
4. Density - 1.9.

C. Capable of being applied in layers up to 38 mm (1-1/2 inches) thick without fillers and up to 100 mm (four inches) thick with fillers, being brought to a feather edge, and being trowelled to a smooth finish.



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- D. Primers, fillers, and reinforcement as required by manufacturer for application and substrate condition.
- E. Ready for use in 48 hours after application.

**2.9 METAL DIVIDER STRIPS**

- A. Heavy top type strip with 5 mm (3/16 inch) wide top and 38 mm (1-1/2 inch) long leg.
- B. Embedded leg perforated and deformed for keying to mortar.
- C. Aluminum or brass as specified in Finish Legend.

**2.10 WATER**

- A. Clean, potable and free from salts and other injurious elements to mortar and grout materials.

**2.11 CLEANING COMPOUNDS**

- A. Specifically designed for cleaning masonry and concrete and which will not prevent bond of subsequent tile setting materials including patching and leveling compounds and elastomeric waterproofing membrane and coat.
- B. Materials containing acid or caustic material not acceptable.

**PART 3 - EXECUTION**

**3.1 ENVIRONMENTAL REQUIREMENTS**

- A. Maintain ambient temperature of work areas at not less than 16 degree C (60 degrees F), without interruption, for not less than 24 hours before installation and not less than three days after installation.
- B. Maintain higher temperatures for a longer period of time where required by manufacturer's recommendation and ANSI Specifications for installation.
- C. Do not install tile when the temperature is above 38 degrees C (100 degrees F).
- D. Do not install materials when the temperature of the substrate is below 16 degrees C (60 degrees F).

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- E. Do not allow temperature to fall below 10 degrees C (50 degrees F) after fourth day of completion of tile work.

**3.2 ALLOWABLE TOLERANCE**

- A. Variation in plane of sub-floor, including concrete fills leveling compounds and mortar beds:

- 1. Not more than 1 in 500 (1/4 inch in 10 feet) from required elevation where Portland cement mortar setting bed is used.
- 2. Not more than 1 in 1000 (1/8 inch in 10 feet) where dry-set Portland cement, and latex-Portland cement mortar setting beds and chemical-resistant bond coats are used.

- B. Variation in Plane of Wall Surfaces:

- 1. Not more than 1 in 400 (1/4 inch in eight feet) from required plane where Portland cement mortar setting bed is used.
- 2. Not more than 1 in 800 (1/8 inch in eight feet) where dry-set or latex-Portland cement mortar or organic adhesive setting materials is used.

**3.3 SURFACE PREPARATION**

- A. Cleaning New Concrete or Masonry:

- 1. Chip out loose material, clean off all oil, grease dirt, adhesives, curing compounds, and other deterrents to bonding by mechanical method, or by using products specifically designed for cleaning concrete and masonry.
- 2. Use self-contained power blast cleaning systems to remove curing compounds and steel trowel finish from concrete slabs where ceramic tile will be installed directly on concrete surface with thin-set materials.
- 3. Steam cleaning or the use of acids and solvents for cleaning will not be permitted.

- B. Patching and Leveling:

- 1. Mix and apply patching and leveling compound in accordance with manufacturer's instructions.

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2. Fill holes and cracks and align concrete floors that are out of required plane with patching and leveling compound.
    - a. Thickness of compound as required to bring finish tile system to elevation shown.
    - b. Float finish except finish smooth for elastomeric waterproofing.
    - c. At substrate expansion, isolation, and other moving joints, allow joint of same width to continue through underlayment.
  3. Apply patching and leveling compound to concrete and masonry wall surfaces that are out of required plane.
  4. Apply leveling coats of material compatible with wall surface and tile setting material to wall surfaces, other than concrete and masonry that are out of required plane.
- C. Mortar Bed for Slopes to Drains:
1. Slope compound to drain where drains are shown.
  2. Install mortar bed in depressed slab sloped to drains not less than 1 in 200 (1/16 inch per foot).
  3. Allow not less than 50 mm (2 inch) depression at edge of depressed slab.
  4. Screed for slope to drain and float finish.
  5. Cure mortar bed for not less than seven days. Do not use curing compounds or coatings.
- D. Additional preparation of concrete floors for tile set with epoxy, or furan-resin shall be in accordance with the manufacturer's printed instructions.
- E. Cleavage Membrane:
1. Install polythene sheet as cleavage membrane in depressed slab when waterproof membrane is not scheduled or indicated.
  2. Turn up at edge of depressed floor slab to top of floor.
- F. Walls:
1. In showers or other wet areas cover studs with polyethylene sheet.

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2. Apply patching and leveling compound to concrete and masonry surfaces that are out of required plane.
3. Apply leveling coats of material compatible with wall surface and tile setting material to wall surfaces, other than concrete and masonry that are out of required plane.
4. Apply metal lath to framing in accordance with ANSI A108.1:
  - a. Use fasteners specified in paragraph "Fasteners." Use washers when lath opening is larger than screw head.
  - b. Apply scratch and leveling coats to metal lath in accordance with ANSI A108.1.C.
  - c. Total thickness of scratch and leveling coats:
    - 1) Apply 9 mm to 16 mm (3/8 inch to 5/8 inch) thick over solid backing.
    - 2) 16 mm to 19 mm (5/8 to 3/4 inch) thick on metal lath over studs.
    - 3) Where wainscots are required to finish flush with wall surface above, adjust thickness required for flush finish.
  - d. Apply scratch and leveling coats more than 19 mm (3/4 inch) thick in two coats.

**G. Existing Floors and Walls:**

1. Remove existing composition floor finishes and adhesive. Prepare surface by grinding, chipping, self-contained power blast cleaning or other suitable mechanical methods to completely expose uncontaminated concrete or masonry surfaces. Follow safety requirements of ANSI A10.20.
2. Remove existing concrete fill or topping to structural slab. Clean and level the substrate for new setting bed and waterproof membrane or cleavage membrane.
3. Where new tile bases are required to finish flush with plaster above or where they are extensions of similar bases in conjunction with existing floor tiles cut channel in floor slab and expose rough wall construction sufficiently to accommodate new tile base and setting material.

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**3.4 CEMENTITIOUS BACKER UNITS**

- A. Remove polyethylene wrapping from cementitious backer units and separate to allow for air circulation. Allow moisture content of backer units to dry down to a maximum of 35 percent before applying joint treatment and tile.
- B. Install in accordance with ANSI A108.1 except as specified otherwise.
- C. Install units horizontally or vertically to minimize joints with end joints over framing members. Units with rounded edges; face rounded edge away from studs to form a V joint for joint treatment.
- D. Secure cementitious backer units to each framing member with screws spaced not more than 200 mm (eight inches) on center and not closer than 13 mm (1/2 inch) from the edge of the backer unit or as recommended by backer unit manufacturer. Install screws so that the screw heads are flush with the surface of the backer unit.
- E. Where backer unit joins shower pans or waterproofing, lap backer unit over turned up waterproof system. Install fasteners only through top one-inch of turned up waterproof systems.
- F. Do not install joint treatment for seven days after installation of cementitious backer unit.
- G. Joint Treatment:
  - 1. Fill horizontal and vertical joints and corners with latex-Portland cement mortar. Apply fiberglass tape over joints and corners and embed with same mortar.
  - 2. Leave 6 mm (1/4 inch) space for sealant at lips of tubs, sinks, or other plumbing receptors.

**3.5 GLASS MAT WATER-RESISTANT GYPSUM BACKER BOARD**

- A. Install in accordance with manufacturer's instructions. TCA Systems W245-01.
- B. Treat joints with tape and latex-Portland cement mortar or adhesive.

**3.6 METAL DIVIDER STRIPS**

- A. Install metal divider strips in floor joints between ceramic and quarry tile floors and between tile floors and adjacent flooring of

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other materials where the finish floors are flush unless shown otherwise.

B. Set divider strip in mortar bed to line and level centered under doors or in openings.

C. At preformed sealant joint:

1. Comply with recommendations in TCA "Handbook for Ceramic Tile Installation" Vertical and Horizontal Joint Design Essentials. TCA System EJ 171-02.

a. Locate joint in tile surfaces directly above joint in sub-floor or where indicated when used with isolation membranes to allow off-setting of joint location from sub-floor joint.

b. Fasten full length to sub-floor using a construction adhesive.

c. Trowel setting material with full coverage over the entire leg.

2. Set tile up against the joint ensuring that the top edge of the joint is flush or slightly below the top of the tile.

**3.7 CERAMIC TILE - GENERAL**

A. Comply with ANSI A108 series of tile installation standards in "Specifications for Installation of Ceramic Tile" applicable to methods of installation.

B. Comply with TCA Installation Guidelines:

C. Installing Mortar Beds for Floors:

1. Install mortar bed to not damage cleavage or waterproof membrane; 32 mm (1-1/2 inch) minimum thickness.

2. Install floor mortar bed reinforcing centered in mortar fill.

3. Screed finish to level plane or slope to drains where shown, float finish.

4. For thin set systems cure mortar bed not less than seven days. Do not use curing compounds or coatings.

5. For tile set with Portland cement paste over plastic mortar bed coordinate to set tile before mortar bed sets.

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**D. Setting Beds or Bond Coats:**

1. Where recessed or depressed floor slabs are filled with Portland cement mortar bed, set ceramic mosaic floor tile in either Portland cement paste over plastic mortar bed or latex-Portland cement mortar over cured mortar bed except as specified otherwise, ANSI A108-1C, TCA System F121-02 or F111-02.
2. Set floor tile in elastomeric bond coat over elastomeric membrane ANSI 108. 13, TCA System F122 where scheduled, and where shown.
3. Set wall tile installed over concrete or masonry in dry-set Portland cement mortar, or latex-Portland cement mortar, ANSI 108.1B.and TCA System W211-02, W221-02 or W222-02.
4. Set wall tile installed over concrete backer board in latex-Portland cement mortar, ANSI A108.1B.
5. Set wall tile installed over Portland cement mortar bed on metal lath base in Portland cement paste over plastic mortar bed, or dry-set Portland cement mortar or latex-Portland cement mortar over a cured mortar bed, ANSI A108.1C, TCA System W231-02, W241-02.
6. Set trim shapes in same material specified for setting adjoining tile.

**E. Workmanship:**

1. Lay out tile work so that no tile less than one-half full size is used. Make all cuts on the outer edge of the field. Align new tile work scheduled for existing spaces to the existing tile work unless specified otherwise.
2. Set tile firmly in place with finish surfaces in true planes. Align tile flush with adjacent tile unless shown otherwise.
3. Form intersections and returns accurately.
4. Cut and drill tile neatly without marring surface.
5. Cut edges of tile abutting penetrations, finish, or built-in items:
  - a. Fit tile closely around electrical outlets, piping, fixtures and fittings, so that plates, escutcheons, collars and flanges will overlap cut edge of tile.

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- b. Seal tile joints water tight as specified in Section 07 92 00, JOINT SEALANTS, around electrical outlets, piping fixtures and fittings before cover plates and escutcheons are set in place.
- 6. Completed work shall be free from hollow sounding areas and loose, cracked or defective tile.
- 7. Remove and reset tiles that are out of plane or misaligned.
- 8. Floors:
  - a. Extend floor tile beneath casework and equipment, except those units mounted in wall recesses.
  - b. b. Align finish surface of new tile work flush with other and existing adjoining floor finish where shown.
  - c. In areas where floor drains occur, slope to drains where shown.
  - d. Shove and vibrate tiles over 200 mm (8 inches) square to achieve full support of bond coat.
- 9. Walls:
  - a. Cover walls and partitions, including pilasters, furred areas, and freestanding columns from floor to ceiling, or from floor to nominal wainscot heights shown with tile.
  - b. Finish reveals of openings with tile, except where other finish materials are shown or specified.
  - c. At window openings, provide tile stools and reveals, except where other finish materials are shown or specified.
  - d. Finish wall surfaces behind and at sides of casework and equipment, except those units mounted in wall recesses, with same tile as scheduled for room proper.
- 10. Joints:
  - a. Keep all joints in line, straight, level, perpendicular and of even width unless shown otherwise.
  - b. Make joints 2 mm (1/16 inch) wide for glazed wall tile and mosaic tile work.
  - c. Make joints in Paver tile, porcelain type; maximum 3 mm (1/8 inch) wide.



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11. Back Buttering: For installations indicated below, obtain 100 percent mortar coverage by complying with applicable special requirements for back buttering of tile in referenced ANSI A108 series of tile installation standards:

- a. Tile wall installations in wet areas, including showers, tub enclosures, laundries and swimming pools.
- b. Tile installed with chemical-resistant mortars and grouts.
- c. Tile wall installations composed of tiles 200 by 200 mm (8 by 8 inches or larger).

**3.8 PORCELAIN TILE INSTALLED WITH LATEX PORTLAND CEMENT BONDONG MORTAR**

- A. Due to the denseness of porcelain tile use latex Portland cement bonding mortar that meets the requirements of ANSI A108.1. Bonding mortars shall be mixed in accordance with manufacturer's instructions. Improper liquid ratios and dwell time before placement of bonding mortar and tile shall affect bond.

**3.9 THIN SET CERAMIC AND PORCELAIN TILE INSTALLED WITH DRY-SET PORTLAND CEMENT AND LATEX-PORTLAND CEMENT MORTAR**

- A. Installation of Tile: ANSI A108.1, except as specified otherwise.
- B. Slope tile work to drains not less than 1 in 100 (1/8 inch per foot).

**3.10 GROUTING**

- A. Grout Type and Location:
  - 1. Grout for glazed wall and base tile, paver tile and unglazed mosaic tile Portland cement grout, latex-Portland cement grout, dry-set grout, or commercial Portland cement grout.
- B. Workmanship:
  - 1. Install and cure grout in accordance with the applicable standard.
  - 2. Portland Cement grout: ANSI A108.1.
  - 3. Epoxy Grout: ANSI A108.1.
  - 4. Commercial Portland Cement Grout: ANSI A108.1 and in accordance with the manufacturer's printed instructions.

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**3.11 MOVEMENT JOINTS**

- A. Prepare tile expansion, isolation, construction and contraction joints for installation of sealant. Refer to Section 07 92 00, JOINT SEALANTS.
- B. TCA details EJ 171-02.
- C. At expansion joints, rake out joint full depth of tile and setting bed and mortar bed. Do not cut waterproof or isolation membrane.
- D. Rake out grout at joints between tile, at toe of base, and where shown not less than 6 mm (1/4 inch) deep.

**3.12 CLEANING**

- A. Thoroughly sponge and wash tile. Polish glazed surfaces with clean dry cloths.
- B. Methods and materials used shall not damage or impair appearance of tile surfaces.
- C. The use of acid or acid cleaners on glazed tile surfaces is prohibited.
- D. Clean tile grouted with epoxy, furan and commercial Portland cement grout and tile set in elastomeric bond coat as recommended by the manufacturer of the grout and bond coat.

**3.13 PROTECTION**

- A. Keep traffic off tile floor, until grout and setting material is firmly set and cured.
- B. Where traffic occurs over tile floor, cover tile floor with not less than 9 mm (3/8 inch) thick plywood, wood particle board, or hardboard securely taped in place. Do not remove protective cover until time for final inspection. Clean tile of any tape, adhesive and stains.

**3.14 TESTING FINISH FLOOR**

- A. Test floors in accordance with ASTM C627 to show compliance with codes 1 through 10.

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SECTION 09 51 00

ACOUSTICAL CEILINGS

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Metal ceiling suspension system for acoustical ceilings.
- B. Acoustical units.

1.2 RELATED WORK

- A. Color, pattern, and location of each type of acoustical unit: Finish Schedule.
- B. Access doors: Section 08 31 13, ACCESS DOORS AND FRAMES.

1.3 SUBMITTALS

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Samples:
  - 1. Acoustical units, each type, with label indicating conformance to specification requirements, including units specified to match existing.
  - 2. Colored markers for units providing access.
- C. Manufacturer's Literature and Data:
  - 1. Ceiling suspension system, each type, showing complete details of installation.
  - 2. Acoustical units, each type

1.4 DEFINITIONS

- A. Standard definitions as defined in ASTM C634.
- B. Terminology as defined in ASTM E1264.

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**1.5 APPLICABLE PUBLICATIONS**

A. Publications listed below form a part of this specification to extent referenced. Publications are referenced in the text by basic designation only.

B. American Society for Testing and Materials (ASTM):

1. A641/A641M-03 Zinc-coated (Galvanized) Carbon Steel Wire
2. A653/A653M-07 Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-coated (Galvannealed) by the Hot-Dip Process
3. C423-07 Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method
4. C634-02 (E2007) Standard Terminology Relating to Environmental Acoustics
5. C635-04 Metal Suspension Systems for Acoustical Tile and Lay-in Panel Ceilings
6. C636-06 Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-in Panels
7. E84-07 Surface Burning Characteristics of Building Materials
8. E119-07 Fire Tests of Building Construction and Materials
9. E413-04 Classification for Rating Sound Insulation.
10. E580-06 Application of Ceiling Suspension Systems for Acoustical Tile and Lay-in Panels in Areas Requiring Seismic Restraint
11. E1264-(R2005) Classification for Acoustical Ceiling Products

**PART 2 - PRODUCTS**

**2.1 METAL SUSPENSION SYSTEM**

- A. ASTM C635, heavy-duty system, except as otherwise specified.
1. Ceiling suspension system members may be fabricated from either of the following unless specified otherwise.
    - a. Galvanized cold-rolled steel, bonderized.

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- b. Fire resistant plastic (glass fiber) having a flame spread and smoke developed rating of not more than 25 when tested in accordance with ASTM E84.
- 2. Use same construction for cross runners as main runners. Use of lighter-duty sections for cross runners is not acceptable.
- B. Exposed grid suspension system for support of lay-in panels:
  - 1. Exposed grid width not less than 14 mm (9/16 inch).
  - 2. Fabricate wall molding and other special molding from the same material with same exposed width and finish as the exposed grid members.
  - 3. On exposed metal surfaces apply baked-on enamel flat texture finish in color to match adjacent acoustical units unless specified otherwise in Finish Schedule.
- C. Extruded-Aluminum Edge Moldings and Trim: Where indicated, provide extruded-aluminum edge moldings and trim of profile indicated, including splice plates, corner pieces, and attachment and other clips, complying with seismic design requirements and the following:
  - 1. Aluminum Alloy: Alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated, and with not less than the strength and durability properties of aluminum extrusions complying with ASTM B 221 for Alloy and Temper 6063-T5.

**2.2 PERIMETER SEAL**

- A. Vinyl, polyethylene or polyurethane open cell sponge material having density of 1.3 plus or minus 10 percent, compression set less than 10 percent with pressure sensitive adhesive coating on one side.
- B. Thickness as required to fill voids between back of wall molding and finish wall.
- C. Not less than 9 mm (3/8 inch) wide strip.

**2.3 WIRE**

- A. ASTM A641.
- B. For wire hangers: Minimum diameter 2.68 mm (0.1055 inch).
- C. For bracing wires: Minimum diameter 3.43 mm (0.1350 inch).

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**2.4 ANCHORS AND INSERTS**

- A. Use anchors or inserts to support twice the loads imposed by hangers attached thereto.
- B. Clips:
1. Galvanized steel.
  2. Designed to clamp to steel beam or bar joists, or secure framing member together.
  3. Designed to rigidly secure framing members together.
  4. Designed to sustain twice the loads imposed by hangers or items supported.

**2.5 CARRYING CHANNELS FOR SECONDARY FRAMING**

- A. Fabricate from cold-rolled or hot-rolled steel, black asphaltic paint finish, free of rust.
- B. Weighing not less than the following, per 300 m (per thousand linear feet):

Size mm	Size Inches	Cold-rolled		Hot-rolled	
		Kg	Pound	Kg	Pound
38	1 1/2	215.4	475	508	1120
50	2	267.6	590	571.5	1260

**2.6 ACOUSTICAL UNITS**

- A. General:
1. Ceiling Tile shall meet minimum 37 percent bio-based content in accordance with USDA Bio-Preferred Product requirements.
  2. ASTM E1264, weighing 3.6 kg/m2 (3/4 psf) minimum for mineral fiber panels or tile.
  3. Class A Flame Spread: ASTM 84
  4. Minimum NRC (Noise Reduction Coefficient): 0.70 unless specified otherwise: ASTM C423.
  5. Minimum CAC (Ceiling Attenuation Class): 35 unless specified

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otherwise: ASTM E413.

6. Manufacturers standard finish, minimum Light Reflectance (LR) coefficient of 0.86 on the exposed surfaces.
7. Lay-in panels: Sizes as shown, with reveal edges.
8. Perforated metal facing (pan); panels:
  - a. Panels: Sizes as shown with 1-3/4-inch integral return edge on each of four panel sides and including steel clips that locate and align panels to grid with torsion springs.
  - b. Sound absorbent element; either non-sifting mineral wool or glass fiber (free of formaldehyde) of density and thickness to provide specified noise reduction coefficient. Enclosure sound absorbent elements within plastic envelopes.
- B. Type IV Units - Mineral base with membrane-faced overlay, Form 2 - Water felted, minimum 16 mm (5/8 inch) thick. Apply over the paint coat on the face of the unit a poly (vinyl) chloride overspray having a flame spread index of 25 or less when tested in accordance with ASTM E84.
- C. Type VII Units - Perforated aluminum facing (pan) with mineral or glass fiber base backing.
  1. Fabricated from aluminum sheets not less than 0.635 mm (0.025 inch) thick.
  2. Panel Finish: PVC-free faux wood veneer permanently bonded to aluminum sheet.

**2.7 ACCESS IDENTIFICATION**

- A. Markers:
  1. Use colored markers with pressure sensitive adhesive on one side.
  2. Make colored markers of paper or plastic, 6 to 9 mm (1/4 to 3/8 inch) in diameter.
- B. Use markers of the same diameter throughout building.
- C. Color Code: Use following color markers for service identification:
  1. Color                      Service
  2. Red                        Sprinkler System: Valves and Controls

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- |           |  |
|-----------|--|
| 3. Green  | Domestic Water: Valves and Controls      |
| 4. Yellow | Chilled Water and Heating Water          |
| 5. Orange | Ductwork: Fire Dampers                   |
| 6. Blue   | Ductwork: Dampers and Controls           |
| 7. Black  | Gas: Laboratory, Medical, Air and Vacuum |

**PART 3 - EXECUTION**

**3.1 CEILING TREATMENT**

- A. Treatment of ceilings shall include sides and soffits of ceiling beams, furred work 600 mm (24 inches) wide and over, and vertical surfaces at changes in ceiling heights unless otherwise shown. Install acoustic tiles after wet finishes have been installed and solvents have cured.
- B. Lay out acoustical units symmetrically about center lines of each room or space unless shown otherwise on reflected ceiling plan.
- C. Moldings:
  - 1. Install metal wall molding at perimeter of room, column, or edge at vertical surfaces.
  - 2. Install special shaped molding at changes in ceiling heights and at other breaks in ceiling construction to support acoustical units and to conceal their edges.
- D. Perimeter Seal:
  - 1. Install perimeter seal between vertical leg of wall molding and finish wall, partition, and other vertical surfaces.
  - 2. Install perimeter seal to finish flush with exposed faces of horizontal legs of wall molding.
- E. Existing ceiling:
  - 1. Where extension of existing ceilings occur, match existing.
  - 2. Where acoustical units are salvaged and reinstalled or joined, use salvaged units within a space. Do not mix new and salvaged units within a space which results in contrast between old and new acoustic units.



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3. Comply with specifications for new acoustical units for new units required to match appearance of existing units.

**3.2 CEILING SUSPENSION SYSTEM INSTALLATION**

**A. General:**

1. Install metal suspension system for acoustical tile and lay-in panels in accordance with ASTM C636, except as specified otherwise.
2. Use direct or indirect hung suspension system or combination thereof as defined in ASTM C635.
3. Support a maximum area of 1.48 m<sup>2</sup> (16 sf) of ceiling per hanger.
4. Prevent deflection in excess of 1/360 of span of cross runner and main runner.
5. Provide extra hangers, minimum of one hanger at each corner of each item of mechanical, electrical and miscellaneous equipment supported by ceiling suspension system not having separate support or hangers.
6. Provide not less than 100 mm (4 inch) clearance from the exposed face of the acoustical units to the underside of ducts, pipe, conduit, secondary suspension channels, concrete beams or joists; and steel beam or bar joist unless furred system is shown,
7. Use main runners not less than 1200 mm (48 inches) in length.
8. Install hanger wires vertically. Angled wires are not acceptable except for seismic restraint bracing wires.

**B. Anchorage to Structure:**

**1. Concrete:**

- a. Install hanger inserts and wire loops required for support of hanger and bracing wire in concrete forms before concrete is placed. Install hanger wires with looped ends through steel deck if steel deck does not have attachment device.
- b. Use eye pins or threaded studs with screw-on eyes in existing or already placed concrete structures to support hanger and bracing wire. Install in sides of concrete beams or joists at mid height.

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2. Steel:

- a. When steel framing does not permit installation of hanger wires at spacing required, install carrying channels for attachment of hanger wires.
  - 1) Size and space carrying channels to insure that the maximum deflection specified will not be exceeded.
  - 2) Attach hangers to steel carrying channels, spaced four feet on center, unless area supported or deflection exceeds the amount specified.
- b. Attach carrying channels to the bottom flange of steel beams spaced not 1200 mm (4 feet) on center before fire proofing is installed. Weld or use steel clips to attach to beam to develop full strength of carrying channel.
- c. Attach hangers to bottom chord of bar joists or to carrying channels installed between the bar joists when hanger spacing prevents anchorage to joist. Rest carrying channels on top of the bottom chord of the bar joists, and securely wire tie or clip to joist.

C. Direct Hung Suspension System:

- 1. As illustrated in ASTM C635.
- 2. Support main runners by hanger wires attached directly to the structure overhead.
- 3. Maximum spacing of hangers, 1200 mm (4 feet) on centers unless interference occurs by mechanical systems. Use indirect hung suspension system where not possible to maintain hanger spacing.

D. Indirect Hung Suspension System:

- 1. As illustrated in ASTM C635.
- 2. Space carrying channels for indirect hung suspension system not more than 1200 mm (4 feet) on center. Space hangers for carrying channels not more than 2400 mm (8 feet) on center or for carrying channels less than 1200 mm (4 feet) on center so as to insure that specified requirements are not exceeded.
- 3. Support main runners by specially designed clips attached to

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carrying channels.

**E. Seismic Ceiling Bracing System:**

1. Construct system in accordance with ASTM E580.
2. Connect bracing wires to structure above as specified for anchorage to structure and to main runner or carrying channels unless otherwise indicated.

**3.3 ACOUSTICAL UNIT INSTALLATION**

- A. Cut acoustic units for perimeter borders and penetrations to fit tight against penetration for joint not concealed by molding.
- B. Install lay-in acoustic panels in exposed grid with not less than 6 mm (1/4 inch) bearing at edges on supports.
  1. Install tile to lay level and in full contact with exposed grid.
  2. Replace cracked, broken, stained, dirty, or tile not cut for minimum bearing.
- C. Markers:
  1. Install markers of color code specified to identify the various concealed piping, mechanical, and plumbing systems.
  2. Attach colored markers to exposed grid on opposite sides of the units providing access.
  3. Attach marker on exposed ceiling surface of upward access acoustical unit.

**3.4 CLEAN-UP AND COMPLETION**

- A. Replace damaged, discolored, dirty, cracked and broken acoustical units.
- B. Leave finished work free from defects.

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SECTION 09 65 13

RESILIENT BASE AND ACCESSORIES

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This section specifies the installation of vinyl or rubber base .

1.2 RELATED WORK

- A. Color and texture: Finish Schedule.
- B. Integral base with sheet flooring: Section 09 65 16, RESILIENT SHEET FLOORING.

1.3 SUBMITTALS

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Manufacturer's Literature and Data:
  - 1. Description of each product.
  - 2. Base material manufacturer's recommendations for adhesives.
  - 3. Application and installation instructions.
- C. Samples:
  - 1. Base: 150 mm (6 inches) long, each type and color.
  - 2. Adhesive: Literature indicating each type.

1.4 DELIVERY

- A. Deliver materials to the site in original sealed packages or containers, clearly marked with the manufacturer's name or brand, type and color, production run number and date of manufacture.
- B. Materials from containers which have been distorted, damaged or opened prior to installation will be rejected.

1.5 STORAGE

- A. Store materials in weather tight and dry storage facility.
- B. Protect material from damage by handling and construction operations before, during, and after installation.

1.6 APPLICABLE PUBLICATIONS

- A. The publication listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.
- B. American Society for Testing and Materials (ASTM):
  - 1. F1861-08 Resilient Wall Base

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**PART 2 - PRODUCTS**

**2.1 GENERAL**

- A. Use only products by the same manufacturer and from the same production run.

**2.2 RESILIENT BASE**

- A. ASTM F1861, 3 mm (1/8 inch) thick, 100 mm (4 inches) high, Thermoplastics, Group 2-layered. Style B-cove.
- B. Where carpet occurs, use Style A-straight.
- C. Use only one type of base throughout.

**2.3 PRIMER (For Concrete Floors)**

- A. As recommended by the adhesive and tile manufacturer.

**2.4 LEVELING COMPOUND (For Concrete Floors)**

- A. Provide products with latex or polyvinyl acetate resins in the mix.

**2.5 ADHESIVES**

- A. Use products recommended by the material manufacturer for the conditions of use.
- B. Use low-VOC adhesive during installation. Water based adhesive with low VOC is preferred over solvent based adhesive.

**PART 3 - EXECUTION**

**3.1 PROJECT CONDITIONS**

- A. Maintain temperature of materials above 21° C (70 °F), for 48 hours before installation.
- B. Maintain temperature of rooms where work occurs, between 21° C and 27° C (70°F and 80°F) for at least 48 hours, before, during, and after installation.
- C. Do not install materials until building is permanently enclosed and wet construction is complete, dry, and cured.

**3.2 INSTALLATION REQUIREMENTS**

- A. The respective manufacturer's instructions for application and installation will be considered for use when approved by the Resident Engineer.
- B. Submit proposed installation deviation from this specification to the Resident Engineer indicating the differences in the method of installation.
- C. The Resident Engineer reserves the right to have test portions of material installation removed to check for non-uniform adhesion and spotty adhesive coverage.

**3.3 PREPARATION**

- A. Examine surfaces on which material is to be installed.

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- B. Fill cracks, pits, and dents with leveling compound.
- C. Level to 3 mm (1/8 inch) maximum variations.
- D. Do not use adhesive for leveling or filling.
- E. Grind, sand, or cut away protrusions; grind high spots.
- F. Clean substrate area of oil, grease, dust, paint, and deleterious substances.
- G. Substrate area dry and cured. Perform manufacturer's recommended bond and moisture test.
- H. Preparation of existing installation:
  - 1. Remove existing base including adhesive.
  - 2. Do not use solvents to remove adhesives.
  - 3. Prepare substrate as specified.

**3.4 BASE INSTALLATION**

- A. Location:
  - 1. Unless otherwise specified or shown, where base is scheduled, install base over toe space of base of casework, lockers, laboratory, pharmacy furniture island cabinets and where other equipment occurs.
  - 2. Extend base scheduled for room into adjacent closet, alcoves, and around columns.
- B. Application:
  - 1. Apply adhesive uniformly with no bare spots.
  - 2. Set base with joints aligned and butted to touch for entire height.
  - 3. Before starting installation, layout base material to provide the minimum number of joints with no strip less than 600 mm (24 inches) length.
    - a. Short pieces to save material will not be permitted.
    - b. Locate joints as remote from corners as the material lengths or the wall configuration will permit.
- C. Form corners and end stops as follows:
  - 1. Score back of outside corner.
  - 2. Score face of inside corner and notch cove.
- D. Roll base for complete adhesion.

**3.5 CLEANING AND PROTECTION**

- A. Clean all exposed surfaces of base and adjoining areas of adhesive spatter before it sets.
- B. Clean and polish materials in the following order:
  - 1. After two weeks, scrub resilient base materials with a minimum amount of water and a mild detergent. Leave surfaces clean and free of detergent residue. Polish resilient base to a gloss finish.

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- 2. Do not polish tread and sheet rubber materials.
- C. When construction traffic is anticipated, cover tread materials with reinforced kraft paper and plywood or hardboard properly secured and maintained until removal is directed by the Resident Engineer.
- D. Where protective materials are removed and immediately prior to acceptance, replace damaged materials and re-clean resilient materials. Damaged materials are defined as having cuts, gouges, scrapes or tears and not fully adhered.

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SECTION 09 65 16

RESILIENT SHEET FLOORING

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

- A. This Section specifies the installation of sheet flooring with backing and integral cove base.
- B. Installation of sheet flooring including following:
  - 1. Heat welded seams.
  - 2. Integral cove base: Installed at intersection of floor and vertical surfaces.

**1.2 RELATED WORK**

- A. Color, pattern and texture: Finish Schedule.
- B. Resilient base over base of lockers, equipment and casework: Section 09 65 13, RESILIENT BASE AND ACCESSORIES.

**1.3 QUALITY CONTROL - QUALIFICATIONS:**

- A. The Contracting Officer shall approve products or service of proposed manufacturer, suppliers, and installers, and the Contractor shall submit certification that:
  - 1. Heat welded seaming is manufacturer's prescribed method of installation.
  - 2. Installer is approved by manufacturer of materials and has technical qualifications, experience, trained personnel, and facilities to install specified items.
  - 3. Manufacturer's product submitted has been in satisfactory operation, on three installations similar and equivalent in size to this project for three years. Submit list of installations.
- B. The sheet vinyl floor coverings shall meet fire performance characteristics as determined by testing products, per ASTM test method, indicated below by Underwriters Laboratories, Inc. (UL) or another recognized testing and inspecting agency acceptable to authorities having jurisdiction.
  - 1. Critical Radiant Flux: 0.45 watts per sq. cm or more, Class I, per ASTM E648.
  - 2. Smoke Density: Less than 450 per ASTM E662.

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- C. The floor covering manufacturer shall certify that products supplied for installation comply with local regulations controlling use of volatile organic compounds (VOC's).

**1.4 SUBMITTALS**

- A. In accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES, submit following:
- B. Manufacturer's Literature and Data:
  - 1. Description of resilient material and accessories to be provided.
  - 2. Resilient material manufacturer's recommendations for adhesives, weld rods, sealants, and underlayment.
  - 3. Application and installation instructions.
- C. Samples:
  - 1. Sheet material, 38 mm by 300 mm (1-1/2 inch by 12 inch), of each color and pattern with a welded seam using proposed welding rod.
  - 2. Cap strip and fillet strip, 300 mm (12 inches) for integral base.
  - 3. Shop Drawings and Certificates: Layout of joints showing patterns where joints are expressed, and type and location of obscure type joints. Indicate orientation of directional patterns.
  - 4. Certificates: Quality Control Certificate Submittals and lists specified in paragraph, QUALIFICATIONS.
  - 5. Edge strips: 150 mm (6 inches) long each type.
  - 6. Adhesive, underlayment and primer: Pint container, each type.

**1.5 PROJECT CONDITIONS**

- A. Maintain temperature of floor materials and room, where work occurs, above 18 deg C (65 deg F) and below 38 deg C (100 deg F) for 48 hours before, during and for 48 hours after installation. After above period, room temperature shall not fall below 13 deg C (55 deg F).
- B. Construction in or near areas to receive flooring work shall be complete, dry and cured. Do not install resilient flooring over slabs until they have been cured and are sufficiently dry to achieve a bond with adhesive. Follow flooring manufacturer's recommendations for bond and moisture testing.
- C. Building shall be permanently enclosed. Schedule construction so that floor receives no construction traffic when completed.

**1.6 DELIVERY, STORAGE AND HANDLING**

- A. Deliver materials to site in original sealed packages or containers; labeled for identification with manufacturer's name and brand.

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- B. Deliver sheet flooring full width roll, completely enclosed in factory wrap, clearly marked with the manufacturer's number, type and color, production run number and manufacture date.
- C. Store materials in weathertight and dry storage facility. Protect from damage due to handling, weather, and construction operations before, during and after installation. Store sheet flooring on end with ambient temperatures maintained as recommended by manufacturer.
- D. Store sheet flooring on end.
- E. Move sheet vinyl floor coverings and installation accessories into spaces where they will be installed at least 48 hours in advance of installation.

**1.7 APPLICABLE PUBLICATIONS**

- A. Publications listed below form a part of this specification to extent referenced. Publications are referenced in text by basic designation only.
- B. American Society For Testing Materials (ASTM):
  - 1. E648-09 Critical Radiant Flux of Floor-Covering Systems Using a Radiant Energy Source.
  - 2. E662-09 Specific Optical Density of Smoke Generated by Solid Materials.
  - 3. F710-08 Practice for Preparing Concrete Floors and Other Monolithic Floors to Receive Resilient Flooring.
  - 4. F1303-04 Sheet Vinyl Floor Covering with Backing.
  - 5. F1869-04 Moisture Vapor Emission Rate of Concrete Subfloor using Anhydrous Calcium Chloride
  - 6. F1913-04 Sheet Vinyl Flooring without Backing
  - 7. F2170-09 Determining Relative Humidity in Concrete Floor Slabs using In-situ Probes
- C. Resilient Floor Covering Institute (RFCI):
  - 1. Recommended Work Practices for Removal of Resilient Floor Coverings.

**1.8 SCHEDULING**

- A. Interior finish work such as plastering, drywall finishing, concrete, terrazzo, ceiling work, and painting work shall be complete and dry before installation. Mechanical, electrical, and other work above ceiling line shall be completed. Heating, ventilating, and air conditioning systems shall be installed and operating in order to

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maintain temperature and humidity requirements.

**1.9 WARRANTY:**

- A. Submit written warranty, in accordance with FAR clause 52.246-21, Warranty of Construction requirements except that warranty period shall be extended to include two (2) years.

**PART 2 - PRODUCTS**

**2.1 SHEET VINYL FLOOR COVERINGS**

- A. Sheet Vinyl Floor Coverings: Smooth face, minimum thickness nominal
- B. 2 mm (0.08 inch). Sheet flooring shall conform to ASTM F1913 and material requirements specified in ASTM F1303, Type II, Grade 1, backing classification not applicable. Foam backed sheet flooring is not acceptable.
- C. Size: Provide maximum size sheet vinyl material produced by manufacturer to provide minimum number of joints. Minimum size width acceptable - 1200 mm (48 inches).
- D. Each color and pattern of sheet flooring shall be of same production run.

**2.2 WELDING ROD:**

- A. Product of floor covering manufacturer in color shall match field color of sheet vinyl covering.

**2.3 APPLICATION MATERIALS AND ACCESSORIES**

- A. Floor and Base Adhesive: Type recommended by sheet flooring material manufacturer for conditions of use.
- B. Mastic Underlayment (for concrete floors): Provide products with latex or polyvinyl acetate resins in mix. Condition to be corrected shall determine type of underlayment selected for use.
- C. Base Accessories:
  - 1. Fillet Strip: 19 mm (3/4 inch) radius fillet strip compatible with resilient sheet material.
  - 2. Cap Strip: Extruded flanged zero edge vinyl reducer strip approximately 25 mm (one inch) exposed height with 13 mm (1/2 inch) flange.

**2.4 SHEET FLOORING**

- A. ASTM F1303, Type II, Grade 1, except for backing requirements. Foam backed sheet flooring is not acceptable.
- B. Minimum nominal thickness 2 mm (0.08 inch); 1800 mm (6 ft) minimum width.

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- C. Critical Radiant Flux: 0.45 watts per sq.cm or more, Class I, per ASTM E648.
- D. Smoke density: less than 450 per ASTM E662.
- E. Color and pattern of sheet flooring of the same production run.

**2.5 ADHESIVES**

- A. Water resistant type recommended by the sheet flooring manufacturer for the conditions of use. VOC not to exceed 50g/L.

**2.6 BASE CAP STRIP AND COVE STRIP**

- A. Extruded vinyl compatible with the sheet flooring.
- B. Cap strip "J" shape with feathered edge flange approximately 25 mm (one inch) wide; top designed to receive sheet flooring with 13 mm (1/2 inch) flange lapping top of flooring
- C. Cove strip 70 mm (2-3/4 inch) radius.

**2.7 LEVELING COMPOUND (FOR CONCRETE FLOORS)**

- A. Provide cementitious products with latex or polyvinyl acetate resins in the mix.

**2.8 PRIMER (FOR CONCRETE SUBFLOORS)**

- A. As recommended by the adhesive or sheet flooring manufacturer.

**2.9 EDGE STRIPS**

- A. Extruded aluminum, mill finish, mechanically cleaned.
- B. 28 mm (1-1/8 inch) wide, 6 mm (1/4 inch) thick, bevel one edge to 3 mm (1/8 inch) thick.
- C. Drill and counter sink edge strips for flat head screws. Space holes near ends and approximately 225 mm (9 inches) on center in between.

**2.10 SEALANT**

- A. As specified in Section 07 92 00, JOINT SEALANTS.
- B. Compatible with sheet flooring.

**PART 3 - EXECUTION**

**3.1 PROJECT CONDITIONS**

- A. Maintain temperature of sheet flooring above 36 deg C (65 deg F), for 48 hours before installation.
- B. Maintain temperature of rooms where sheet flooring work occurs above 36 deg C (65 deg F), for 48 hours, before installation and during installation.
- C. After installation, maintain temperature at or above 36 deg C 65 deg F.
- D. Building is permanently enclosed.

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- E. Wet construction in or near areas to receive sheet flooring is complete, dry and cured.

**3.2 SUBFLOOR PREPARATION**

- A. Concrete Subfloors: Verify that concrete slabs comply with ASTM F710.
  - 1. Installer shall examine surfaces on which resilient sheet flooring is to be installed, and shall advise Contractor, in writing, of areas which are unacceptable for installation of flooring material. Installer shall advise Contractor which methods are to be used to correct conditions that will impair proper installation. Installation shall not proceed until unsatisfactory conditions have been corrected.
  - 2. Slab substrates dry, free of curing compounds, sealers, hardeners, and other materials which would interfere with bonding of adhesive. Determine adhesion and dryness characteristics by performing bond and moisture tests recommended by Resilient Floor Covering Institute recommendations in manual RFCI-MRP.
- B. Broom or vacuum clean substrates to be covered by sheet vinyl floor coverings immediately before installation. Following cleaning, examine substrates to determine if there is visually any evidence of moisture, alkaline salts, carbonation, or dust.
- C. Primer: If recommended by flooring manufacturer, prior to application of adhesive, apply concrete slab primer in accordance with manufacturer's directions.
- D. Correct conditions which will impair proper installation, including trowel marks, pits, dents, protrusions, cracks or joints.
- E. Fill cracks, joints, depressions, and other irregularities in concrete with leveling compound.
  - 1. Do not use adhesive for filling or leveling purposes.
  - 2. Do not use leveling compound to correct imperfections which can be corrected by spot grinding.
  - 3. Trowel to smooth surface free of trowel marks, pits, dents, protrusions, cracks or joint lines.
- F. Clean floor of oil, paint, dust and deleterious substances. Leave floor dry and cured free of residue from existing curing or cleaning agents.
- G. Moisture Testing: Perform moisture and pH test as recommended by the flooring and adhesive manufacturers. Perform test locations starting

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on the deepest part of the concrete structure. Proceed with installation only after concrete substrates meet or exceed the manufacturer's requirements. In the absence of specific guidance from the flooring or adhesive manufacturer the following requirements are to be met:

1. Perform moisture vapor emission tests in accordance with ASTM F1869. Proceed with installation only after substrates have a maximum moisture-vapor-emission rate of 1.36 kg of water/92.9 sq. m (3lb of water/1000 sq. ft.) in 24 hours.
  2. Perform concrete internal relative humidity testing using situ probes in accordance with ASTM F2170. Proceed with installation only after concrete reaches maximum 75 percent relative humidity level measurement.
- H. Preparation shall include the removal of existing resilient floor and existing adhesive. Do not use solvents to remove adhesives. Coordinate with Asbestos Abatement Section if asbestos abatement procedures will be involved.
- I. Remove existing resilient flooring and adhesive completely in accordance with Resilient Floor Covering Institute recommendations in manual RFCI-WP. Solvents shall not be used.

**3.3 INSTALLATION OF FLOORING**

- A. Install work in strict compliance with manufacturer's instructions and approved layout drawings.
- B. Maintain uniformity of sheet vinyl floor covering direction and avoid cross seams.
- C. Arrange for a minimum number of seams and place them in inconspicuous and low traffic areas, but in no case less than 150 mm (6 inches) away from parallel joints in flooring substrates.
- D. Match edges of resilient floor coverings for color shading and pattern at seams.
- E. Where resilient sheet flooring abuts other flooring material floors shall finish level.
- F. Extend sheet vinyl floor coverings into toe spaces, door reveals, closets, and similar openings.
- G. Inform the Resident Engineer of conflicts between this section and the manufacturer's instructions or recommendations for auxiliary materials, or installation methods, before proceeding.

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- H. Install sheet in full coverage adhesives.
  - 1. Air pockets or loose edges will not be accepted.
  - 2. Trim sheet materials to touch in the length of intersection at pipes and vertical projections; seal joints at pipe with waterproof cement or sealant.
- I. Keep joints to a minimum; avoid small filler pieces or strips.
- J. Follow manufacturer's recommendations for seams at butt joints. Do not leave any open joints that would be readily visible from a standing position.
- K. Follow manufacturer's recommendations regarding pattern match, if applicable.
- L. Installation of Edge Strips:
  - 1. Locate edge strips under center lines of doors unless otherwise indicated.
  - 2. Set aluminum strips in adhesive, anchor with lead anchors and stainless steel Phillips screws.
- M. Integral Cove Base Installation:
  - 1. Set preformed fillet strip to receive base.
  - 2. Install the base with adhesive, terminate expose edge with the cap strip.
  - 3. Form internal and external corners to the geometric shape generated by the cove at either straight or radius corners.
  - 4. Solvent weld joints as specified for the flooring. Seal cap strip to wall with an adhesive type sealant.
  - 5. Unless otherwise specified or shown where sheet flooring is scheduled, provide integral base at intersection of floor and vertical surfaces. Provide sheet flooring and base scheduled for room on floors and walls under and behind areas where casework, laboratory and pharmacy furniture and other equipment occurs, except where mounted in wall recesses.

**3.4 INSTALLATION OF INTEGRAL COVED BASE**

- A. Set preformed cove to receive base. Install base material with adhesive and terminate exposed edge with cap strip. Integral base shall be 100 mm (4 inches) high, unless otherwise indicated on Drawings or in Finish Schedule.
- B. Internal and external corners shall be formed to geometric shape generated by cove at either square or radius corners.



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**3.5 WELDING**

- A. Heat weld all joints of flooring and base using equipment and procedures recommended by flooring manufacturer.
- B. Welding shall consist of routing joint, inserting a welding rod into routed space, and terminally fusing into a homogeneous joint.
- C. Upon completion of welding, surface across joint shall finish flush, free from voids, and recessed or raised areas.
- D. Fusion of Material: Joint shall be fused a minimum of 65 percent through thickness of material, and after welding shall meet specified characteristics for flooring.

**3.6 CLEANING**

- A. Clean small adhesive marks during application of sheet flooring and base before adhesive sets, excessive adhesive smearing will not be accepted.
- B. Remove visible adhesive and other surface blemishes using methods and cleaner recommended by floor covering manufacturers.
- C. Clean and polish materials per flooring manufacturer's written recommendations.
- D. Vacuum floor thoroughly.
- E. Do not wash floor until after period recommended by floor covering manufacturer and then prepare in accordance with manufacturer's recommendations.
- F. Upon completion, Resident Engineer shall inspect floor and base to ascertain that work was done in accordance with manufacturer's printed instructions.
- G. Perform initial maintenance according to flooring manufacturer's written recommendations.

**3.7 PROTECTION:**

- A. Protect installed flooring as recommended by flooring manufacturer against damage from rolling loads, other trades, or placement of fixtures and furnishings.
- B. Keep traffic off sheet flooring for 24 hours after installation.
- C. Where construction traffic is anticipated, cover sheet flooring with reinforced kraft paper properly secured and maintained until removal is authorized by the Resident Engineer.

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- D. Where protective materials are removed and immediately prior to acceptance, repair any damage, re-clean sheet flooring, lightly re-apply polish and buff floor.

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SECTION 09 65 19

RESILIENT TILE FLOORING

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This section specifies the installation of solid vinyl tile flooring, biobased composition tile flooring, and accessories.

1.2 RELATED WORK

- A. Color and pattern and location in room finish schedule: Finish Schedule.
- B. Resilient Base: Section 09 65 13, RESILIENT BASE AND ACCESSORIES.

1.3 SUBMITTALS

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Manufacturer's Literature and Data:
  - 1. Description of each product.
  - 2. Resilient material manufacturers' recommendations for adhesives, underlayment, primers and polish.
  - 3. Application and installation instructions.
- C. Samples:
  - 1. Tile: 300 mm by 300 mm (12 inches by 12 inches) for each type, pattern and color.
  - 2. Edge Strips: 150 mm (6 inches) long, each type.
  - 3. Feature Strips: 150 mm (6 inches) long.

1.4 DELIVERY

- A. Deliver materials to the site in original sealed packages or containers, clearly marked with the manufacturer's name or brand, type and color, production run number and date of manufacture.
- B. Materials from containers which have been distorted, damaged or opened prior to installation will be rejected.

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**1.5 STORAGE**

- A. Store materials in weathertight and dry storage facility.
- B. Protect from damage from handling, water, and temperature.

**1.6 APPLICABLE PUBLICATIONS**

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.

- B. American Society for Testing and Materials (ASTM):

- 1. D4078-02 (2008) Water Emulsion Floor Finish
- 2. E648-10 Critical Radiant Flux of Floor Covering Systems Using a Radiant Energy Source
- 3. E662-09 Specific Optical Density of Smoke Generated by Solid Materials
- 4. E1155-96 (R2008) Determining Floor Flatness and Floor Levelness Numbers
- 5. F510-93 (R 2008) Resistance to Abrasion of Resilient Floor Coverings Using an Abrader with a Grit Feed Method
- 6. F710-08 Preparing Concrete Floors to Receive Resilient Flooring
- 7. F1700-04 (R2010) Solid Vinyl Floor Tile

- C. Resilient Floor Covering Institute (RFCI):

- 1. IP #2 Installation Practice for Vinyl Composition Tile (VCT)

- D. Federal Specifications (Fed. Spec.):

- 1. SS-T-312 Tile Floor: Asphalt, Rubber, Vinyl and Vinyl Composition

**PART 2 - PRODUCTS**

**2.1 GENERAL**

- A. Furnish product type, materials of the same production run and meeting following criteria.
- B. Use adhesives, underlayment, primers and polish recommended by the floor resilient material manufacturer.

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- C. Critical Radiant Flux: 0.45 watts per sq. cm or more, Class I, per ASTM E 648.
- D. Smoke density: Less than 450 per ASTM E662.

**2.2 BIOBASED COMPOSITION TILE**

- A. ASTM F2982, 300 mm (12 inches) square, 3 mm (1/8 inch) thick.
- B. Color and pattern uniformly distributed throughout thickness.

**2.3 SOLID VINYL-TILE**

- A. ASTM F1700, 300 mm (12 by 12 inches) square, 3 mm (1/8 inch) thick, homogenous throughout.
- B. Color and Pattern uniformly distributed throughout thickness.
- C. Where solid vinyl tiles are specified, seek products with recycled content.

**2.4 ADHESIVES**

- A. Comply with applicable regulations regarding toxic and hazardous materials Green Seal (GS-36) for commercial adhesive.
- B. Use low-VOC adhesive during installation. Water based is preferred over solvent based adhesives.

**2.5 PRIMER (FOR CONCRETE SUBFLOORS)**

- A. As recommended by the adhesive and tile manufacturer.

**2.6 LEVELING COMPOUND (For Concrete Floors)**

- A. Provide cementitious products with latex or polyvinyl acetate resins in the mix.
- B. Determine the type of underlayment selected for use by the condition to be corrected.

**2.7 EDGE STRIPS**

- A. 28 mm (1-1/8 inch) wide unless shown otherwise.
- B. Bevel from maximum thickness to minimum thickness for flush joint unless shown otherwise.

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- C. Extruded aluminum, mill finish, mechanically cleaned:
  - 1. Drill and counter sink edge strip for flat head screws.
  - 2. Space holes near ends and approximately 225 mm (9 inches) on center between.
- D. Resilient Edge Strip or Reducer Strip: Fed. Specs. SS-T-312, Solid vinyl.

**PART 3 - EXECUTION**

**3.1 PROJECT CONDITIONS**

- A. Maintain temperature of materials a minimum of 22 °C (70 °F,) for 48 hours before installation.
- B. Maintain temperature of rooms where work occurs between 21 °C and 27 °C (70 °F and 80 °F), for at least 48 hours, before, during and after installation.
- C. Do not install flooring until building is permanently enclosed and wet construction in or near areas to receive tile materials is complete, dry and cured.

**3.2 SUBFLOOR PREPARATION**

- A. Verify that concrete slabs comply with ASTM F710. At existing slabs, determine levelness by F-number method in accordance with ASTM E1155. Overall value shall not exceed as follows:
  - 1. FF30/FL20
- B. Correct conditions which will impair proper installation.
- C. Fill cracks, joints and other irregularities in concrete with leveling compound:
  - 1. Do not use adhesive for filling or leveling purposes.
  - 2. Do not use leveling compound to correct imperfections which can be corrected by spot grinding.
  - 3. Trowel to smooth surface free of trowel marks, pits, dents, protrusions, cracks or joints.

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- D. Clean floor of oil, paint, dust, and deleterious substances: Leave floor dry and cured free of residue from existing curing or cleaning agents.
- E. Concrete Subfloor Testing:
  - 1. Determine Adhesion and dryness of the floor by bond and moisture tests as recommended by RFCI manual MRP.
- F. Perform additional subfloor preparation to obtain satisfactory adherence of flooring if subfloor test patches allows easy removal of tile.
- G. Prime the concrete subfloor if the primer will seal slab conditions that would inhibit bonding, or if priming is recommended by the tile or adhesive manufacturers.
- H. Preparation of existing installation shall include the removal of existing resilient floor and existing adhesive. Do not use solvents to remove adhesives.

**3.3 INSTALLATION**

- A. Install in accordance with manufacturer's instructions for application and installation unless specified otherwise.
- B. Mix tile from at least two containers. An apparent line either of shades or pattern variance will not be accepted.
- C. Tile Layout:
  - 1. If layout is not shown on drawings, lay tile symmetrically about center of room or space with joints aligned.
  - 2. No tile shall be less than 150 mm (6 inches) and of equal width at walls.
  - 3. Place tile pattern in the same direction; do not alternate tiles.
- D. Trim tiles to touch for the length of intersections at pipes and vertical projections, seal joints at pipes with waterproof cement.
- E. Application:
  - 1. Apply adhesive uniformly with no bare spots.
    - a. Conform to RFC1-TM-6 for joint tightness and for corner intersection unless layout pattern shows random corner

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intersection.

b. More than 5 percent of the joints not touching will not be accepted.

2. Roll tile floor with a minimum 45 kg (100 pound) roller. No exceptions.

3. The Resident Engineer may have test tiles removed to check for non-uniform adhesion, spotty adhesive coverage, and ease of removal. Install new tile for broken removed tile.

**F. Installation of Edge Strips:**

1. Locate edge strips under center line of doors unless otherwise shown.

2. Set resilient edge strips in adhesive. Anchor metal edge strips with anchors and screws specified.

3. Where tile edge is exposed, butt edge strip to touch along tile edge.

4. Where thin set ceramic tile abuts resilient tile, set edge strip against floor file and against the ceramic tile edge.

**3.4 CLEANING AND PROTECTION**

A. Clean adhesive marks on exposed surfaces during the application of resilient materials before the adhesive sets. Exposed adhesive is not acceptable.

B. Keep traffic off resilient material for a minimum 72 hours after installation.

C. Clean and polish materials in the following order:

1. For the first two weeks sweep and damp mopped only.

2. After two weeks, scrub resilient materials with a minimum amount of water and a mild detergent. Leave surface clean and free of detergent residue.

3. Apply polish to the floors in accordance with the polish manufacturer's instructions.

D. When construction traffic occurs over tile, cover resilient materials with reinforced kraft paper properly secured and maintained until



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removal is directed by Resident Engineer. At entrances and where wheeled vehicles or carts are used, cover tile with plywood, hardboard, or particle board over paper, secured and maintained until removal is directed by Resident Engineer.

- E. When protective materials are removed and immediately prior to acceptance, replace any damage tile, re-clean resilient materials, lightly re-apply polish and buff floors.

**3.5 LOCATION**

- A. Unless otherwise specified or shown, install tile flooring, on floor under areas where casework, laboratory and pharmacy furniture and other equipment occurs, except where mounted in wall recesses.
- B. Extend tile flooring for room into adjacent closets and alcoves.

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SECTION 09 68 00

CARPETING

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Section specifies carpet, edge strips, adhesives, and other items required for complete installation.

1.2 RELATED WORK

- A. Color and texture of carpet and edge strip: Finish Schedule.
- B. Resilient wall base: Section 09 65 13, RESILIENT BASE AND ACCESSORIES.

1.3 QUALITY ASSURANCE

- A. Carpet installed by mechanics certified by the Floor Covering Installation Board.
- B. Certify and label the carpet that it has been tested and meets criteria of CRI IAQ Carpet Testing Program for indoor air quality.

1.4 SUBMITTALS

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. Product Data:

1. Manufacturer's catalog data and printed documentation stating physical characteristics, durability, resistance to fading and flame resistance characteristics for each type of carpet material and installation accessory.
2. Manufacturer's printed installation instructions for the carpet, including preparation of installation substrate, seaming techniques and recommended adhesives and tapes.
3. Manufacturer's certificate verifying carpet containing recycled materials include percentage of recycled materials as specified.

C. Samples:

1. Carpet: "Production Quality" samples 300 x 300 mm (12 x 12 inches) of carpets, showing quality, pattern and color specified in Finish

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Schedule.

2. Floor Edge Strip (Molding): 150 mm (6 inches) long of each color and type specified.
  3. Base Edge Strip (Molding): 150 mm (6 inches) long of each color specified.
- D. Maintenance Data: Carpet manufacturer's maintenance instructions describing recommended type of cleaning equipment and material, spotting and cleaning methods and cleaning cycles.

**1.5 DELIVERY AND STORAGE**

- A. Deliver carpet in manufacturer's original wrappings and packages clearly labeled with manufacturer's name, brand, name, size, dye lot number and related information.
- B. Deliver adhesives in containers clearly labeled with manufacturer's name, brand name, number, installation instructions, safety instructions and flash points.
- C. Store in a clean, dry, well ventilated area, protected from damage and soiling. Maintain storage space at a temperature above 16 degrees C (60 degrees F) for 2 days prior to installation.

**1.6 ENVIRONMENTAL REQUIREMENTS**

- A. Areas in which carpeting is to be installed shall be maintained at a temperature above 16 degrees C (60 degrees F) for 2 days before installation, during installation and for 2 days after installation. A minimum temperature of 13 degrees C (55 degrees F) shall be maintained thereafter for the duration of the contract. Traffic or movement of furniture or equipment in carpeted area shall not be permitted for 24 hours after installation. Other work which would damage the carpet shall be completed prior to installation of carpet.

**1.7 WARRANTY**

- A. Carpet and installation subject to terms of "Warranty of Construction" FAR clause 52.246-21, except that warranty period is extended to two years.

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**1.8 APPLICABLE PUBLICATIONS**

A. Publication listed below form a part of this specification to extent referenced. Publications are referenced in text by basic designation only.

B. American National Standards Institute (ANSI):

1. ANSI/NSF 140-10 Sustainable Carpet Assessment Standard

C. American Association of Textile Chemists and Colorists (AATCC):

1. AATCC 16-04 Colorfastness to Light

2. AATCC 129-10 Colorfastness to Ozone in the Atmosphere under High Humidities

3. AATCC 134-11 Electric Static Propensity of Carpets

4. AATCC 165-08 Colorfastness to Crocking: Textile Floor Coverings-AATCC Crockmeter Method

D. American Society for Testing and Materials (ASTM):

1. ASTM D1335-05 Tuft Bind of Pile Yarn Floor Coverings

2. ASTM D3278-96 (R2004) Flash Point of Liquids by Small Scale Closed-Cup Apparatus

3. ASTM D5116-10 Determinations of Organic Emissions from Indoor Materials/Products

4. ASTM D5252-05 Operation of the Hexapod Tumble Drum Tester

5. ASTM D5417-05 Operation of the Vettermann Drum Tester

6. ASTM E648-10 Critical Radiant Flux of Floor-Covering Systems Using a Radiant Heat Energy Source

E. The Carpet and Rug Institute (CRI):

1. CRI 104-11 Installation of Commercial Carpet

**PART 2 - PRODUCTS**

**2.1 CARPET**

A. Physical Characteristics:

1. Carpet free of visual blemishes, streaks, poorly dyed areas, fuzzing of pile yarn, spots or stains and other physical and

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manufacturing defects.

2. Manufacturers standard construction commercial carpet:
  - a. Modular Tile: 550 mm (19.69 inches) square tile.
3. Provide static control to permanently control static build up to less than 3.0 kV when tested at 20 percent relative humidity and 21 degrees C (70 degrees F) in accordance with AATCC 134.
4. Pile Height: Maximum 6.1 mm (0.24 inch).
5. Pile Fiber: Nylon with recycled content 25 percent minimum branded (federally registered trademark).
6. Pile Type: Tufted Sheared.
7. Backing materials: Manufacturer's unitary backing designed for glue-down installation using recovered materials.
8. Appearance Retention Rating (ARR): Carpet shall be tested and have the minimum 3.5-4.0 Severe ARR when tested in accordance with either the ASTM D 5252 (Hexapod) or ASTM D 5417 (Vettermann) test methods using the number of cycles for short and long term tests as specified.
9. Tuft Bind: Minimum force of 40 N (10 lb) required to pull a tuft or loop free from carpet backing. Test per ASTM D1335.
10. Colorfastness to Crocking: Dry and wet crocking and water bleed, comply with AATCC 165 Color Transference Chart for colors, minimum class 4 rating.
11. Colorfastness to Ozone: Comply with AATCC 129, minimum rating of 4 on the AATCC color transfer chart.
12. Delamination Strength: Minimum of 440 N/m (2.5 lb/inch) between secondary backing.
13. Flammability and Critical Radiant Flux Requirements:
  - a. Test Carpet in accordance with ASTM E 648.
  - b. Class I: Not less than 0.45 watts per square centimeter.
  - c. Carpet in corridors, exits and Medical Facilities: Class I.
14. Density: Average Pile Yarn Density (APYD):
  - a. Minimum APYD 5390.

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15. VOC Limits: Use carpet and carpet adhesive that comply with the following limits for VOC content when tested according to ASTM D 5116:

- a. Carpet, Total VOCs: 0.5 mg/sq.m x hr.
- b. Carpet, 4-PC (4-Phenylcyclohexene): 0.05 mg/sq.m x hr.
- c. Carpet, Formaldehyde: 0.05 mg/sq.m x hr.
- d. Carpet, Styrene: 0.4 mg/sq.m x hr.
- e. Adhesive, Total VOCs: 10.00 mg/sq.m x hr.
- f. Adhesive, Formaldehyde: 0.05 mg/sq.m x hr.
- g. Adhesive, 2-Ethyl-1-Hexanol: 3.00 mg/sq.m x hr.

B. Shall meet platinum level of ANSI/NSF 140.

C. Color, Texture, and Pattern: As specified in Finish Schedule.

**2.2 ADHESIVE AND CONCRETE PRIMER**

A. Waterproof, resistant to cleaning solutions, steam and water, nonflammable, complies with air-quality standards as specified. Adhesives flashpoint minimum 60 degrees C (140 degrees F), complies with ASTM D 3278.

B. Seam Adhesives: Waterproof, non-flammable and non-staining.

**2.3 SEAMING TAPE**

A. Permanently resistant to carpet cleaning solutions, steam, and water.

B. Recommended by carpet manufacturer.

**2.4 EDGE STRIPS (MOLDING)**

A. Metal:

- 1. Hammered surface aluminum, pinless, clamp down type designed for the carpet being installed.
- 2. Floor flange not less than 38 mm (1-1/2 inches) wide, face not less than 16 mm (5/8 inch) wide.
- 3. Finish: Clear anodic coating unless specified otherwise in Section 090600, SCHEDULE FOR FINISHES.

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**B. Vinyl Edge Strip:**

1. Beveled floor flange minimum 50 mm (2 inches) wide.
2. Beveled surface to finish flush with carpet for tight joint and other side to floor finish.
3. Color as specified in Finish Legend.

**2.5 LEVELING COMPOUND (FOR CONCRETE FLOORS)**

- A. Provide Portland cement bases polymer modifier with latex or polyvinyl acetate resin manufactured specifically for resurfacing and leveling concrete floors. Products containing gypsum are not acceptable.
- B. Determine the type of underlayment selected for use by condition to be corrected.

**PART 3 - EXECUTION**

**3.1 SURFACE PREPARATION**

- A. Examine surfaces on which carpeting is to be installed.
- B. Clean floor of oil, waxy films, paint, dust and deleterious substances that prevent adhesion, leave floor dry and cured, free of residue from curing or cleaning agents .
- C. Correct conditions which will impair proper installation, including trowel marks, pits, dents, protrusions, cracks or joints.
- D. Fill cracks, joints depressions, and other irregularities in concrete with leveling compound.
  1. Do not use adhesive for filling or leveling purposes.
  2. Do not use leveling compound to correct imperfections which can be corrected by spot grinding.
  3. Trowel to smooth surface free of trowel marks, pits, dents, protrusions, cracks or joint lines.
- E. Test new concrete subfloor prior to adhesive application for moisture and surface alkalinity per CRI 104 Section 6.3.1 or per ASTM E1907.

**3.2 CARPET INSTALLTION**

- A. Do not install carpet until work of other trades including painting



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is complete and dry.

- B. Install in accordance with CRI 104 direct glue down installation.
  - 1. Relax carpet in accordance with Section 6.4.
  - 2. Comply with indoor air quality recommendations noted in Section 6.5.
  - 3. Maintain temperature in accordance with Section 15.3.
- C. Secure carpet to subfloor of spaces with adhesive applied as recommended by carpet manufacturer.
- D. Follow carpet manufacturer's recommendations for matching pattern and texture directions.
- E. Cut openings in carpet where required for installing equipment, pipes, outlets, and penetrations.
  - 1. Bind or seal cut edge of sheet carpet and replace flanges or plates.
  - 2. Use additional adhesive to secure carpets around pipes and other vertical projections.
- F. Broadloom Carpet:
  - 1. Install per CRI 104, Section 8.
  - 2. Lay broadloom carpet lengthwise in longest dimension of space, with minimum seams, uniformly spaced to provide a tight smooth finish, free from movement when subjected to traffic.
  - 3. Use tape-seaming method to join sheet carpet edges. Do not leave visible seams.
- G. Carpet Modules:
  - 1. Install per CRI 104, Section 13, Adhesive Application.
  - 2. Lay carpet modules with pile in same direction unless specified otherwise in Finish Schedule.
  - 3. Install carpet modules so that cleaning methods and solutions do not cause dislocation of modules.
  - 4. Lay carpet modules uniformly to provide tight flush joints free from movement when subject to traffic.

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**3.3 EDGE STRIPS INSTALLATION**

- A. Install edge strips over exposed carpet edges adjacent to uncarpeted finish flooring.
- B. Anchor metal strips to floor with suitable fasteners. Apply adhesive to edge strips, insert carpet into lip and press it down over carpet.
- C. Anchor vinyl edge strip to floor with adhesive apply adhesive to edge strip and insert carpet into lip and press lip down over carpet.

**3.4 PROTECTION AND CLEANING**

- A. Remove waste, fasteners and other cuttings from carpet floors.
- B. Vacuum carpet and provide suitable protection. Do not use polyethylene film.
- C. Do not permit traffic on carpeted surfaces for at least 48 hours after installation. Protect the carpet in accordance with CRI 104.
- D. Do not move furniture or equipment on unprotected carpeted surfaces.
- E. Just before final acceptance of work, remove protection and vacuum carpet clean.

- - - E N D - - -

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**SECTION 09 77 23 - FABRIC-WRAPPED PANELS**

**PART 1 - GENERAL**

**1.1 SUMMARY**

- A. Section includes shop-fabricated, fabric-wrapped wall panels.

**1.2 SUBMITTALS**

- A. Product Data: For each type of fabric facing, panel edge, core material, and mounting indicated.

- B. Shop Drawings: For fabric-wrapped wall panels. Include mounting devices and details; details at panel head, base, joints, and corners; and details at ceiling, floor base, and wall intersections. Indicate panel edge and core materials.

- 1. Include elevations showing panel sizes and direction of fabric weave and pattern matching.

- C. Samples for Initial Selection: For each type of fabric facing from fabric-wrapped, wall panel manufacturer's full range.

- D. Samples for Verification: For the following products, prepared on Samples of size indicated below:

- 1. Fabric: Full-width by approximately 36-inch- long Sample, but not smaller than required to show complete pattern repeat, from dye lot to be used for the Work, and with specified treatments applied. Mark top and face of fabric.

- 2. Panel Edge: 12-inch- long Sample(s) showing each edge profile, corner, and finish.

- 3. Core Material: 12-inch- square Sample at corner.

- 4. Mounting Devices: Full-size Samples.

- 5. Assembled Panels: Approximately 36 by 36 inches, including joints and mounting methods.

- E. Coordination Drawings: Elevations and other details, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:

- 1. Electrical outlets, switches, and thermostats.

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2. Items penetrating or covered by fabric-wrapped wall panels including the following:

- a. Lighting fixtures.
- b. Air outlets and inlets.
- c. Speakers.
- d. Alarms.
- e. Sprinklers.
- f. Access panels.

3. Show operation of hinged and sliding components covered by or adjacent to fabric-wrapped wall panels.

F. Maintenance Data: For fabric-wrapped wall panels to include in maintenance manuals. Include fabric manufacturers' written cleaning and stain-removal recommendations.

**1.3 MAINTENANCE MATERIAL SUBMITTALS**

A. Furnish extra materials from same production run that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

- 1. Fabric: For each fabric, colors, and pattern installed, provide length equal to 10 percent of amount installed, but no fewer than 10 yards.
- 2. Mounting Devices: Full-size units equal to 5 percent of amount installed, but no fewer than five devices, including unopened adhesives.

**1.4 QUALITY ASSURANCE**

A. Fire-Test-Response Characteristics: Provide fabric-wrapped wall panels meeting the following as determined by testing identical products by UL or another testing and inspecting agency acceptable to authorities having jurisdiction:

- 1. Surface-Burning Characteristics: As determined by testing per ASTM E 84.
  - a. Flame-Spread Index: 25 or less.

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b. Smoke-Developed Index: 450 or less.

2. Fire Growth Contribution: Meeting acceptance criteria of local code and authorities having jurisdiction when tested according to NFPA 265.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Comply with fabric and fabric-wrapped, wall panel manufacturers' written instructions for minimum and maximum temperature and humidity requirements for shipment, storage, and handling.
- B. Deliver materials and panels in unopened bundles and store in a temperature-controlled dry place with adequate air circulation.

1.6 PROJECT CONDITIONS

- A. Environmental Limitations: Do not install fabric-wrapped wall panels until spaces are enclosed and weathertight, wet work in spaces is complete and dry, work at and above ceilings is complete, and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.
- B. Lighting: Do not install fabric-wrapped wall panels until a permanent level of lighting is provided on surfaces to receive fabric-wrapped wall panels.
- C. Air-Quality Limitations: Protect fabric-wrapped wall panels from exposure to airborne odors such as tobacco smoke, and install panels under conditions free from odor contamination of ambient air.
- D. Field Measurements: Verify locations of fabric-wrapped wall panels and actual dimensions of openings and penetrations by field measurements before fabrication.

1.7 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of fabric-wrapped wall panels that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

- a. Fabric sagging, distorting, or releasing from panel edge.

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b. Warping of core.

2. Warranty Period: Two years from date of Substantial Completion.

**PART 2 - PRODUCTS**

**2.1 FABRIC-WRAPPED WALL PANELS**

A. Fabric-Wrapped Wall Panel: Manufacturer's standard panel construction consisting of facing material laminated to front face, edges, and back edge border of core.

1. Mounting: Edge mounted with splines secured to substrate.

a. Finish Color at Exposed Edges: As selected by Architect from manufacturer's full range.

2. Mounting: Back mounted with manufacturer's standard method, secured to substrate.

3. Core: Manufacturer's standard.

4. Edge Construction: Manufacturer's standard chemically hardened core with no frame.

5. Edge Profile: Custom profile as indicated on Drawings.

6. Corner Detail in Elevation: Custom as indicated on Drawings with continuous edge profile indicated.

7. Reveals between Panels: Reveals as indicated on Drawings.

8. Facing Material: As indicated on Drawings.

9. Nominal Thickness: As indicated on Drawings.

10. Panel Width: As indicated on Drawings.

11. Panel Height: As indicated on Drawings.

**2.2 FABRICATION**

A. General: Use manufacturer's standard construction except as otherwise indicated; with facing material applied to face, edges, and back border of dimensionally stable core; and with rigid edges to reinforce panel perimeter against warpage and damage.

B. Cores: Chemically harden core edges and areas of core where mounting devices are attached.

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- C. Facing Material: Apply fabric fully covering visible surfaces of panel; with material stretched straight, on the grain, tight, square, and free from puckers, ripples, wrinkles, sags, blisters, seams, adhesive, or other visible distortions or foreign matter.
  - 1. Square Corners: Tailor corners. Heat seal vinyl fabric seams at corners.
  - 2. Radius and Other Nonsquare Corners: Attach material so there are no seams or gathering of material.
  - 3. Fabrics with Directional or Repeating Patterns or Directional Weave: Mark fabric top and attach fabric in same direction so pattern or weave matches in adjacent panels.
- D. Dimensional Tolerances of Finished Panels: Plus or minus 1/16 inch for the following:
  - 1. Thickness.
  - 2. Edge straightness.
  - 3. Overall length and width.
  - 4. Squareness from corner to corner.
  - 5. Chords, radii, and diameters.

**PART 3 - EXECUTION**

**3.1 EXAMINATION**

- A. Examine fabric, fabricated panels, substrates, areas, and conditions, for compliance with requirements, installation tolerances, and other conditions affecting performance of fabric-wrapped wall panels.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

**3.2 INSTALLATION**

- A. Install fabric-wrapped wall panels in locations indicated with vertical surfaces and edges plumb, top edges level and in alignment with other panels, faces flush, and scribed to fit adjoining work accurately at borders and at penetrations.
- B. Comply with fabric-wrapped, wall panel manufacturer's written

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instructions for installation of panels using type of mounting devices indicated. Mount panels securely to supporting substrate.

C. Align and level fabric pattern and grain among adjacent panels.

**3.3 INSTALLATION TOLERANCES**

A. Variation from Plumb and Level: Plus or minus 1/16 inch.

**3.4 CLEANING**

A. Clip loose threads; remove pills and extraneous materials.

B. Clean panels on completion of installation to remove dust and other foreign materials according to manufacturer's written instructions.

END OF SECTION



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**SECTION 09 91 00**

**PAINTING**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

- A. Section specifies field painting.
- B. Section specifies prime coats which may be applied in shop under other sections.
- C. Painting includes shellacs, stains, varnishes, coatings specified, and striping or markers and identity markings.

**1.2 RELATED WORK**

- A. Shop prime painting of steel and ferrous metals: Division 05 - METALS, Division 08 - OPENINGS, Division 10 - SPECIALTIES, Division 11 - EQUIPMENT, Division 12 - FURNISHINGS, Division 13 - SPECIAL CONSTRUCTION, Division 14 - CONVEYING EQUIPMENT, Division 21 - FIRE SUPPRESSION, Division 22 - PLUMBING, Division 23 - HEATING, VENTILATION AND AIR-CONDITIONING, Division 26 - ELECTRICAL, Division 27 - COMMUNICATIONS, and Division 28 - ELECTRONIC SAFETY AND SECURITY sections.
- B. Prefinished flush doors with transparent finishes: Section 08 14 00, INTERIOR WOOD DOORS.
- C. Type of Finish, Color, and Gloss Level of Finish Coat: Finish Schedule.

**1.3 SUBMITTALS**

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Manufacturer's Literature and Data:
  - 1. Before work is started, or sample panels are prepared, submit manufacturer's literature, the current Master Painters Institute (MPI) "Approved Product List" indicating brand label, product name and product code as of the date of Contract award, will be used to determine compliance with the submittal requirements of this specification. The Contractor may choose to use subsequent MPI

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"Approved Product List", however, only one list may be used for the entire Contract and each coating system is to be from a single manufacturer. All coats on a particular substrate must be from a single manufacturer. No variation from the MPI "Approved Product List" where applicable is acceptable.

**C. Sample Panels:**

1. After painters' materials have been approved and before work is started submit sample panels showing each type of finish and color specified.
2. Panels to show color: Composition board, 100 by 250 by 3 mm (4 inch by 10 inch by 1/8 inch).
3. Panel to show transparent finishes: Wood of same species and grain pattern as wood approved for use, 100 by 250 by 3 mm (4 inch by 10 inch face by 1/4 inch) thick minimum, and where both flat and edge grain will be exposed, 250 mm (10 inches) long by sufficient size, 50 by 50 mm (2 by 2 inch) minimum or actual wood member to show complete finish.
4. Attach labels to panel stating the following:
  - a. Federal Specification Number or manufacturers name and product number of paints used.
  - b. Specification code number specified in Finish Schedule.
  - c. Product type and color.
  - d. Name of project.
5. Strips showing not less than 50 mm (2 inch) wide strips of undercoats and 100 mm (4 inch) wide strip of finish coat.

**D. Sample of identity markers if used.**

**E. Manufacturers' Certificates indicating compliance with specified requirements:**

1. Manufacturer's paint substituted for Federal Specification paints meets or exceeds performance of paint specified.
2. Epoxy coating.

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**1.4 DELIVERY AND STORAGE**

- A. Deliver materials to site in manufacturer's sealed container marked to show following:
  - 1. Name of manufacturer.
  - 2. Product type.
  - 3. Batch number.
  - 4. Instructions for use.
  - 5. Safety precautions.
- B. In addition to manufacturer's label, provide a label legibly printed as following:
  - 1. Federal Specification Number, where applicable, and name of material.
  - 2. Surface upon which material is to be applied.
  - 3. If paint or other coating, state coat types; prime, body or finish.
- C. Maintain space for storage, and handling of painting materials and equipment in a neat and orderly condition to prevent spontaneous combustion from occurring or igniting adjacent items.
- D. Store materials at site at least 24 hours before using, at a temperature between 18 and 30 degrees C (65 and 85 degrees F).

**1.5 MOCK-UP PANEL**

- A. Before starting application of water paint mixtures,, apply paint as specified to an area, not to exceed 9 m2 (100 ft2), selected by Resident Engineer.
- B. Finish and texture approved by Resident Engineer will be used as a standard of quality for remainder of work.

**1.6 APPLICABLE PUBLICATIONS**

- A. Publications listed below form a part of this specification to the extent referenced. Publications are referenced in the text by basic designation only.
- B. American Conference of Governmental Industrial Hygienists (ACGIH):
  - 1. ACGIH TLV-BKLT-2008 Threshold Limit Values (TLV) for Chemical

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Substances and Physical Agents and Biological Exposure Indices  
(BEIs)

2. ACGIH TLV-DOC-2008                      Documentation of Threshold Limit  
Values and Biological Exposure Indices, (Seventh Edition)

C. American National Standards Institute (ANSI):

1. A13.1-96 Scheme for the Identification of Piping Systems

D. American Society for Testing and Materials (ASTM):

1. D260-86 Boiled Linseed Oil

E. Federal Specifications (Fed Spec):

1. TT-P-1411A              Paint, Copolymer-Resin, Cementitious (For  
Waterproofing Concrete and Masonry Walls) (CEP)

F. Master Painters Institute (MPI):

1. 4-07              Interior/ Exterior Latex Block Filler
2. 22-07            Aluminum Paint, High Heat (up to 590° - 1100F) (HR)
3. 31-07            Polyurethane, Moisture Cured, Clear Gloss (PV)
4. 43-07            Interior Satin Latex, MPI Gloss Level 4
5. 44-07            Interior Low Sheen Latex, MPI Gloss Level 2
6. 45-07            Interior Primer Sealer
7. 46-07            Interior Enamel Undercoat
8. 47-07            Interior Alkyd, Semi-Gloss, MPI Gloss Level 5 (AK)
9. 48-07            Interior Alkyd, Gloss, MPI Gloss Level 6 (AK)
10. 49-07 Interior Alkyd, Flat, MPI Gloss Level 1 (AK)
11. 50-07 Interior Latex Primer Sealer
12. 51-07 Interior Alkyd, Eggshell, MPI Gloss Level 3
13. 52-07 Interior Latex, MPI Gloss Level 3 (LE)
14. 53-07 Interior Latex, Flat, MPI Gloss Level 1 (LE)
15. 54-07 Interior Latex, Semi-Gloss, MPI Gloss Level 5 (LE)
16. 71-07 Polyurethane, Moisture Cured, Clear, Flat (PV)
17. 74-07 Interior Alkyd Varnish, Semi-Gloss

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18. 77-07 Epoxy Cold Cured, Gloss (EC)
19. 90-07 Interior Wood Stain, Semi-Transparent (WS)
20. 94-07 Exterior Alkyd, Semi-Gloss (EO)
21. 98-07 High Build Epoxy Coating
22. 101-07 Epoxy Anti-Corrosive Metal Primer
23. 114-07 Interior Latex, Gloss (LE) and (LG)
24. 119-07 Exterior Latex, High Gloss (acrylic) (AE)
25. 138-07 Interior High Performance Latex, MPI Gloss Level  
2 (LF)
26. 139-07 Interior High Performance Latex, MPI Gloss Level  
3 (LL)

G. Steel Structures Painting Council (SSPC):

1. SSPC SP 1-04 (R2004) Solvent Cleaning
2. SSPC SP 2-04 (R2004) Hand Tool Cleaning
3. SSPC SP 3-04 (R2004) Power Tool Cleaning

**PART 2 - PRODUCTS**

**2.1 MATERIALS**

- A. Identity markers options:
1. Pressure sensitive vinyl markers.
  2. Snap-on coil plastic markers.
- B. Interior/Exterior Latex Block Filler: MPI 4.
- C. Exterior Alkyd, Flat (EO): MPI 8.
- D. Exterior Alkyd Enamel (EO): MPI 9.
- E. Exterior Latex, Flat (AE): MPI 10.
- F. Exterior Latex, Semi-Gloss (AE): MPI 11.
- G. Organic Zinc rich Coating (HR): MPI 22.
- H. High Heat Resistant Coating (HR): MPI 22.
- I. Interior Satin Latex: MPI 43.

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- J. Interior Low Sheen Latex: MPI 44.
- K. Interior Primer Sealer: MPI 45.
- L. Interior Enamel Undercoat: MPI 46.
- M. Interior Alkyd, Semi-Gloss (AK): MPI 47.
- N. Interior Alkyd, Gloss (AK): MPI 48.
- O. Interior Latex Primer Sealer: MPI 50.
- P. Interior Alkyd, Eggshell: MPI 51
- Q. Interior Latex, MPI Gloss Level 3 (LE): MPI 52.
- R. Interior Latex, Flat, MPI Gloss Level 1 (LE): MPI 53.
- S. Interior Latex, Semi-Gloss, MPI Gloss Level 5 (LE): MPI 54.
- T. Epoxy Cold Cured, Gloss (EC): MPI 77.
- U. Interior Wood Stain, Semi-Transparent (WS): MPI 90.
- V. Exterior Alkyd, Semi-Gloss (EO): MPI 94.
- W. High Build Epoxy Coating: MPI 98.
- X. Epoxy Anti-Corrosive Metal Primer: MPI 101.
- Y. Interior latex, Gloss (LE) and (LG): MPI 114.
- Z. Waterborne Galvanized Primer: MPI 134.
- AA. Non-Cementitious Galvanized Primer: MPI 135.
- BB. Interior High Performance Latex, MPI Gloss Level 2(LF): MPI 138.
- CC. Interior High Performance Latex, MPI Gloss Level 3 (LL): MPI 139.

**2.2 METALLIC FINISH SYSTEM COMPONENTS (PT-9)**

- A. Performance:
  - 1. VOC Content: Less than 131 g/l of VOC's.
  - 2. Fire Rating: Type I or Class A fire-rated, ASTM E 84.
  - 3. Provide coatings that contain anti-microbial to inhibit growth of mold, mildew, and bacteria on paint film.
  - 4. Meet or exceed 4200 scrub cycles on ASTM D 2486 test.

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- B. Primer: Recommended by coating manufacturer for substrate.
  - 1. Primed Metals: No primer required.
  - 2. Unprimed Metals: In accordance with coating manufacturer's recommendations.
- C. Base Coat: Water-based polyurethane/acrylic base coat and cross-linker.
- D. Clear Coat: Water-based polyurethane protective clear coat with cross-linker.
- E. Miscellaneous Materials: Surface patching compounds and other materials necessary for application of finish system shall be of high quality and compatible with coating system.

**2.3 PAINT PROPERTIES**

- A. Use ready-mixed (including colors), except two component epoxies, polyurethanes, polyesters, paints having metallic powders packaged separately and paints requiring specified additives.
- B. Where no requirements are given in the referenced specifications for primers, use primers with pigment and vehicle, compatible with substrate and finish coats specified.

**2.4 REGULATORY REQUIREMENTS/QUALITY ASSURANCE**

- A. Paint materials shall conform to the restrictions of the local Environmental and Toxic Control jurisdiction.
  - 1. Volatile Organic Compounds (VOC): VOC content of paint materials shall not exceed 10g/l for interior latex paints/primers and 50g/l for exterior latex paints and primers.
  - 2. Lead-Based Paint:
    - a. Comply with Section 410 of the Lead-Based Paint Poisoning Prevention Act, as amended, and with implementing regulations promulgated by Secretary of Housing and Urban Development.
    - b. Regulations concerning prohibition against use of lead-based paint in federal and federally assisted construction, or rehabilitation of residential structures are set forth in Subpart F, Title 24, Code of Federal Regulations, Department

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of Housing and Urban Development.

3. Asbestos: Materials shall not contain asbestos.
4. Chromate, Cadmium, Mercury, and Silica: Materials shall not contain zinc- chromate, strontium-chromate, Cadmium, mercury or mercury compounds or free crystalline silica.
5. Human Carcinogens: Materials shall not contain any of the ACGIH-BKLT and ACGHI-DOC confirmed or suspected human carcinogens.
6. Use high performance acrylic paints in place of alkyd paints, where possible.
7. VOC content for solvent-based paints shall not exceed 250g/l and shall not be formulated with more than one percent aromatic hydrocarbons by weight.

**PART 3 - EXECUTION**

**3.1 JOB CONDITIONS**

- A. Safety: Observe required safety regulations and manufacturer's warning and instructions for storage, handling and application of painting materials.
  1. Take necessary precautions to protect personnel and property from hazards due to falls, injuries, toxic fumes, fire, explosion, or other harm.
  2. Deposit soiled cleaning rags and waste materials in metal containers approved for that purpose. Dispose of such items off the site at end of each days work.
- B. Atmospheric and Surface Conditions:
  1. Do not apply coating when air or substrate conditions are:
    - a. Less than 3 degrees C (5 degrees F) above dew point.
    - b. Below 10 degrees C (50 degrees F) or over 35 degrees C (95 degrees F), unless specifically pre-approved by the Contracting Officer and the product manufacturer. Under no circumstances shall application conditions exceed manufacturer recommendations.
  2. Maintain interior temperatures until paint dries hard.



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3. Do no exterior painting when it is windy and dusty.
4. Do not paint in direct sunlight or on surfaces that the sun will soon warm.
5. Apply only on clean, dry and frost free surfaces except as follows:
  - a. Apply water thinned acrylic and cementitious paints to damp (not wet) surfaces where allowed by manufacturer's printed instructions.
  - b. Dampened with a fine mist of water on hot dry days concrete and masonry surfaces to which water thinned acrylic and cementitious paints are applied to prevent excessive suction and to cool surface.
6. Varnishing:
  - a. Apply in clean areas and in still air.
  - b. Before varnishing vacuum and dust area.
  - c. Immediately before varnishing wipe down surfaces with a tack rag.

**3.2 SURFACE PREPARATION**

- A. Method of surface preparation is optional, provided results of finish painting produce solid even color and texture specified with no overlays.
- B. General:
  1. Remove prefinished items not to be painted such as lighting fixtures, escutcheon plates, hardware, trim, and similar items for reinstallation after paint is dried.
  2. Remove items for reinstallation and complete painting of such items and adjacent areas when item or adjacent surface is not accessible or finish is different.
  3. See other sections of specifications for specified surface conditions and prime coat.
  4. Clean surfaces for painting with materials and methods compatible with substrate and specified finish. Remove any residue remaining from cleaning agents used. Do not use solvents, acid, or steam on

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concrete and masonry.

**C. Wood:**

1. Sand to a smooth even surface and then dust off.
2. Sand surfaces showing raised grain smooth between each coat.
3. Wipe surface with a tack rag prior to applying finish.
4. Surface painted with an opaque finish:
  - a. Coat knots, sap and pitch streaks with MPI 36 (Knot Sealer) before applying paint.
  - b. Apply two coats of MPI 36 (Knot Sealer) over large knots.
5. After application of prime or first coat of stain, fill cracks, nail and screw holes, depressions and similar defects with wood filler paste. Sand the surface to make smooth and finish flush with adjacent surface.
6. Before applying finish coat, reapply wood filler paste if required, and sand surface to remove surface blemishes. Finish flush with adjacent surfaces.
7. Fill open grained wood such as oak, walnut, ash and mahogany with MPI 91 (Wood Filler Paste), colored to match wood color.
  - a. Thin filler in accordance with manufacturer's instructions for application.
  - b. Remove excess filler, wipe as clean as possible, dry, and sand as specified.

**D. Ferrous Metals:**

1. Remove oil, grease, soil, drawing and cutting compounds, flux and other detrimental foreign matter in accordance with SSPC-SP 1 (Solvent Cleaning).
2. Remove loose mill scale, rust, and paint, by hand or power tool cleaning, as defined in SSPC-SP 2 (Hand Tool Cleaning) and SSPC-SP 3 (Power Tool Cleaning). Exception: where high temperature aluminum paint is used, prepare surface in accordance with paint manufacturer's instructions.
3. Fill dents, holes and similar voids and depressions in flat exposed

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surfaces of hollow steel doors and frames, access panels, roll-up steel doors and similar items specified to have semi-gloss or gloss finish with TT-F-322D (Filler, Two- Component Type, For Dents, Small Holes and Blow-Holes). Finish flush with adjacent surfaces.

- a. This includes flat head countersunk screws used for permanent anchors.
  - b. Do not fill screws of item intended for removal such as glazing beads.
4. Spot prime abraded and damaged areas in shop prime coat which expose bare metal with same type of paint used for prime coat. Feather edge of spot prime to produce smooth finish coat.
  5. Spot prime abraded and damaged areas which expose bare metal of factory finished items with paint as recommended by manufacturer of item.

**E. Zinc-Coated (Galvanized) Metal Surfaces Specified Painted:**

1. Clean surfaces to remove grease, oil and other deterrents to paint adhesion in accordance with SSPC-SP 1 (Solvent Cleaning).
2. Spot coat abraded and damaged areas of zinc-coating which expose base metal on hot-dip zinc-coated items with MPI 18 (Organic Zinc Rich Coating). Prime or spot prime with MPI 134 (Waterborne Galvanized Primer) or MPI 135 (Non- Cementitious Galvanized Primer) depending on finish coat compatibility.

**F. Masonry and Concrete:**

1. Clean and remove dust, dirt, oil, grease efflorescence, form release agents, laitance, and other deterrents to paint adhesion.
2. Use emulsion type cleaning agents to remove oil, grease, paint and similar products. Use of solvents, acid, or steam is not permitted.
3. Remove loose mortar in masonry work.
4. Repair broken and spalled concrete edges with concrete patching compound to match adjacent surfaces as specified in CONCRETE Sections. Remove projections to level of adjacent surface by grinding or similar methods.

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**G. Gypsum Board:**

1. Remove efflorescence, loose and chalking plaster or finishing materials.
2. Remove dust, dirt, and other deterrents to paint adhesion.
3. Fill holes, cracks, and other depressions with CID-A-A-1272A Gypsum (Spackling Compound) finished flush with adjacent surface, with texture to match texture of adjacent surface. Patch holes over 25 mm (1-inch) in diameter as specified in Section for gypsum board.

**3.3 PAINT PREPARATION**

- A. Thoroughly mix painting materials to ensure uniformity of color, complete dispersion of pigment and uniform composition.
- B. Do not thin unless necessary for application and when finish paint is used for body and prime coats. Use materials and quantities for thinning as specified in manufacturer's printed instructions.
- C. Remove paint skins, then strain paint through commercial paint strainer to remove lumps and other particles.
- D. Mix two component and two part paint and those requiring additives in such a manner as to uniformly blend as specified in manufacturer's printed instructions unless specified otherwise.
- E. For tinting required to produce exact shades specified, use color pigment recommended by the paint manufacturer.

**3.4 APPLICATION**

- A. Start of surface preparation or painting will be construed as acceptance of the surface as satisfactory for the application of materials.
- B. Unless otherwise specified, apply paint in three coats; prime, body, and finish. When two coats applied to prime coat are the same, first coat applied over primer is body coat and second coat is finish coat.
- C. Apply each coat evenly and cover substrate completely.
- D. Allow not less than 48 hours between application of succeeding coats, except as allowed by manufacturer's printed instructions, and approved by Resident Engineer.

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- E. Finish surfaces to show solid even color, free from runs, lumps, brushmarks, laps, holidays, or other defects.
- F. Apply by brush, roller or spray, except as otherwise specified.
- G. Do not spray paint in existing occupied spaces unless approved by Resident Engineer, except in spaces sealed from existing occupied spaces.
  - 1. Apply painting materials specifically required by manufacturer to be applied by spraying.
  - 2. In areas, where paint is applied by spray, mask or enclose with polyethylene, or similar air tight material with edges and seams continuously sealed including items specified in WORK NOT PAINTED, motors, controls, telephone, and electrical equipment, fronts of sterilizers and other recessed equipment and similar prefinished items.
- H. Do not paint in closed position operable items such as access doors and panels, window sashes, overhead doors, and similar items except overhead roll-up doors and shutters.

**3.5 PRIME PAINTING**

- A. After surface preparation prime surfaces before application of body and finish coats, except as otherwise specified.
- B. Spot prime and apply body coat to damaged and abraded painted surfaces before applying succeeding coats.
- C. Additional field applied prime coats over shop or factory applied prime coats are not required except for exterior exposed steel apply an additional prime coat.
- D. Prime rebates for stop and face glazing of wood, and for face glazing of steel.
- E. Wood and Wood Particleboard:
  - 1. Use same kind of primer specified for exposed face surface.
    - a. Interior wood except for transparent finish: MPI 45 (Interior Primer Sealer) or MPI 46 (Interior Enamel Undercoat), thinned if recommended by manufacturer.
    - b. Transparent finishes as specified under Transparent Finishes

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on Wood except Floors.

2. Apply two coats of sealer MPI 45 (Interior Primer Sealer) or MPI 46 (Interior Enamel Undercoat) to surfaces of wood doors, including top and bottom edges, which are cut for fitting or for other reason.
3. Apply one coat of sealer MPI 45 (Interior Primer Sealer) or MPI 46 (Interior Enamel Undercoat) as soon as delivered to site to surfaces of unfinished woodwork, except concealed surfaces of shop fabricated or assembled millwork and surfaces specified to have varnish, stain or natural finish.

**F. Metals except boilers, incinerator stacks, and engine exhaust pipes:**

1. Steel and iron: MPI 95 (Fast Drying Metal Primer). Use MPI 101 (Cold Curing Epoxy Primer) where MPI 98 (High Build Epoxy Coating) finish is specified.
2. Zinc-coated steel and iron: MPI 134 (Waterborne Galvanized Primer).
3. Machinery not factory finished: MPI 9 (Exterior Alkyd Enamel (EO)).
4. Metal over 94 degrees C. (200 degrees F), Boilers, Incinerator Stacks, and Engine Exhaust Pipes: MPI 22 (High Heat Resistant Coating (HR)).

**G. Gypsum Board:**

1. Surfaces scheduled to have MPI 53 (Interior Latex, Flat) , MPI (Gloss Level 1 LE), MPI 52 (Interior Latex, MPI Gloss Level 3 (LE),) and MPI 54 (Interior Latex, Semi-Gloss, MPI Gloss Level 5 (LE)) .
2. Primer: MPI 50 (Interior Latex Primer Sealer) except use MPI 45 (Interior Primer Sealer) or MPI 46 (Interior Enamel Undercoat) in shower and bathrooms.
3. Surfaces scheduled to receive vinyl coated fabric wallcovering: Use MPI 45 (Interior Primer Sealer) or MPI 46 (Interior Enamel Undercoat).
4. Use MPI 101 (Cold Curing Epoxy Primer) for surfaces scheduled to receive MPI 77 (Epoxy Cold Cured, Gloss (EC)) or MPI 98 (High Build Epoxy Coating) finish.

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H. Concrete Masonry Units except glazed or integrally colored and decorative units:

1. MPI 4 (Block Filler) on interior surfaces.

**3.6 INTERIOR FINISHES**

A. Apply following finish coats over prime coats in spaces or on surfaces specified in Finish Schedule.

B. Metal Work:

1. Apply to exposed surfaces.
2. Omit body and finish coats on surfaces concealed after installation except electrical conduit containing conductors over 600 volts.
3. Ferrous Metal, Galvanized Metal, and Other Metals Scheduled:
  - a. Apply two coats of MPI 47 (Interior Alkyd, Semi-Gloss (AK) unless specified otherwise.
  - b. Machinery: One coat MPI 9 (Exterior Alkyd Enamel (EO)).
  - c. Ferrous Metal over 94 degrees K (200 degrees F): Boilers, Incinerator Stacks, and Engine Exhaust Pipes: One coat MPI 22 (High Heat Resistant Coating (HR)).

C. Gypsum Board:

1. One coat of MPI 45 (Interior Primer Sealer) or MPI 46 (Interior Enamel Undercoat) plus one coat of MPI 139 (Interior High Performance Latex, MPI Gloss level 3 (LL)).
2. Two coats of MPI 138 (Interior High Performance Latex, MPI Gloss Level 2 (LF)).

D. Masonry and Concrete Walls:

1. Over MPI 4 (Interior/Exterior Latex Block Filler) on CMU surfaces.
2. Two coats of MPI 53 (Interior Latex, Flat, MPI Gloss Level 1 (LE)) or MPI 52 (Interior Latex, MPI Gloss Level 3 (LE)).
3. Two coats of MPI 138 (Interior High Performance Latex, MPI Gloss Level 2 (LF) or MPI 139 (Interior High Performance Latex, MPI Gloss level 3 (LL)).

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E. Wood:

1. Sanding:

- a. Use 220-grit sandpaper.
- b. Sand sealers and varnish between coats.
- c. Sand enough to scarify surface to assure good adhesion of subsequent coats, to level roughly applied sealer and varnish, and to knock off "whiskers" of any raised grain as well as dust particles.

2. Sealers:

- a. Apply sealers specified except sealer may be omitted where pigmented, penetrating, or wiping stains containing resins are used.
- b. Allow manufacturer's recommended drying time before sanding, but not less than 24 hours or 36 hours in damp or muggy weather.
- c. Sand as specified.

3. Transparent Finishes on Wood Except Floors.

a. Natural Finish:

- 1) One coat of sealer as written in 2.1 E.
- 2) Two coats of MPI 71 (Polyurethane, Moisture Cured, Clear Flat (PV)).

b. Stain Finish:

- 1) One coat of MPI 90 (Interior Wood Stain, Semi-Transparent (WS)).
- 2) Use wood stain of type and color required to achieve finish specified. Do not use varnish type stains.
- 3) One coat of sealer as written in 2.1 E.
- 4) Two coats of MPI 71 (Polyurethane, Moisture Cured, Clear Flat (PV) or MPI 31 (Polyurethane Moisture Cured, Clear Gloss (PV)

c. Varnish Finish:

- 1) One coat of sealer as written in 2.1 E.



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- 2) Two coats of MPI 71 (Polyurethane, Moisture Cured, Clear Flat (PV0) or MPI 31 (Polyurethane Moisture Cured, Clear Gloss (PV)).

**F. Miscellaneous:**

1. Apply where specified in Finish Schedule.

**3.7 REFINISHING EXISTING PAINTED SURFACES**

- A. Clean, patch and repair existing surfaces as specified under surface preparation.
- B. Remove and reinstall items as specified under surface preparation.
- C. Remove existing finishes or apply separation coats to prevent non compatible coatings from having contact.
- D. Patched or Replaced Areas in Surfaces and Components: Apply spot prime and body coats as specified for new work to repaired areas or replaced components.
- E. Except where scheduled for complete painting apply finish coat over plane surface to nearest break in plane, such as corner, reveal, or frame.
- F. In existing rooms and areas where alterations occur, clean existing stained and natural finished wood retouch abraded surfaces and then give entire surface one coat of MPI 31 (Polyurethane, Moisture Cured, Clear Gloss) or MPI 71 (Polyurethane, Moisture Cured, Clear Flat (PV)).
- G. Refinish areas as specified for new work to match adjoining work unless specified or scheduled otherwise.
- H. Coat knots and pitch streaks showing through old finish with MPI 36 (Knot Sealer) before refinishing.
- I. Sand or dull glossy surfaces prior to painting.
- J. Sand existing coatings to a feather edge so that transition between new and existing finish will not show in finished work.

**3.8 PAINT COLOR**

- A. Color and gloss of finish coats is specified in Finish Schedule.
- B. For additional requirements regarding color see Articles, REFINISHING EXISTING PAINTED SURFACE and MECHANICAL AND ELECTRICAL FIELD PAINTING

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SCHEDULE.

C. Coat Colors:

1. Color of priming coat: Lighter than body coat.
2. Color of body coat: Lighter than finish coat.
3. Color prime and body coats to not show through the finish coat and to mask surface imperfections or contrasts.

D. Painting, Caulking, Closures, and Fillers Adjacent to Casework:

1. Paint to match color of casework where casework has a paint finish.
2. Paint to match color of wall where casework is stainless steel, plastic laminate, or varnished wood.

**3.9 MECHANICAL AND ELECTRICAL WORK FIELD PAINTING SCHEDULE**

- A. Field painting of mechanical and electrical consists of cleaning, touching-up abraded shop prime coats, and applying prime, body and finish coats to materials and equipment if not factory finished in space scheduled to be finished.
- B. In spaces not scheduled to be finish painted in Finish Schedule paint as specified under paragraph H, colors.
- C. Paint various systems specified in Division 02 - EXISTING CONDITIONS, Division 21 - FIRE SUPPRESSION, Division 22 - PLUMBING, Division 23 - HEATING, VENTILATION AND AIR-CONDITIONING, Division 26 - ELECTRICAL, Division 27 - COMMUNICATIONS, and Division 28 - ELECTRONIC SAFETY AND SECURITY.
- D. Paint after tests have been completed.
- E. Omit prime coat from factory prime-coated items.
- F. Finish painting of mechanical and electrical equipment is not required when located in interstitial spaces, above suspended ceilings, in concealed areas such as pipe and electric closets, pipe basements, pipe tunnels, trenches, attics, roof spaces, shafts and furred spaces except on electrical conduit containing feeders 600 volts or more.
- G. Omit field painting of items specified in paragraph, Building and Structural WORK NOT PAINTED.

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H. Color:

1. Paint items having no color specified in Finish Schedule to match surrounding surfaces.
2. Paint colors as specified in Finish Schedule except for following:
  - a. White: Exterior unfinished surfaces of enameled plumbing fixtures. Insulation coverings on breeching and uptake inside boiler house, drums and drum-heads, oil heaters, condensate tanks and condensate piping.
  - b. Gray: Heating, ventilating, air conditioning and refrigeration equipment (except as required to match surrounding surfaces), and water and sewage treatment equipment and sewage ejection equipment.
  - c. Aluminum Color: Ferrous metal on outside of boilers and in connection with boiler settings including supporting doors and door frames and fuel oil burning equipment, and steam generation system (bare piping, fittings, hangers, supports, valves, traps and miscellaneous iron work in contact with pipe).
  - d. Federal Safety Red: Exposed fire protection piping hydrants, post indicators, electrical conducts containing fire alarm control wiring, and fire alarm equipment.
  - e. Federal Safety Orange: Entire lengths of electrical conduits containing feeders 600 volts or more.
  - f. Color to match brickwork sheet metal covering on breeching outside of exterior wall of boiler house.

I. Apply paint systems on properly prepared and primed surface as follows:

1. Interior Locations:
  - a. Apply two coats of MPI 47 (Interior Alkyd, Semi-Gloss (AK)) to following items:
    - 1) Metal under 94 degrees C (200 degrees F) of items such as bare piping, fittings, hangers and supports.
    - 2) Equipment and systems such as hinged covers and frames for control cabinets and boxes, cast-iron radiators, electric

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conduits and panel boards.

- 3) Heating, ventilating, air conditioning, plumbing equipment, and machinery having shop prime coat and not factory finished.
  - b. Apply one coat of MPI 50 (Interior Latex Primer Sealer) and one coat of MPI 53 (Interior Latex, Flat, MPI Gloss Level 1 (LE)), MPI 44 (Interior Low Sheen Latex,) MPI 52 (Interior Latex, MPI Gloss Level 3 (LE)), MPI 43 (Interior Satin Latex), or MPI 54 (Interior Latex, Semi-Gloss, MPI Gloss Level 5 (LE)) on finish of insulation on boiler breeching and uptakes inside boiler house, drums, drumheads, oil heaters, feed water heaters, tanks and piping.
  - c. Apply two coats of MPI 22 (High Heat Resistant Coating (HR)) to ferrous metal surface over 94 degrees K (200 degrees F) of following items:
    - 1) Exterior of boilers and ferrous metal in connection with boiler settings including supporting members, doors and door frames and fuel oil burning equipment.
    - 2) Steam line flanges, bare pipe, fittings, valves, hangers and supports over 94 degrees K (200 degrees F).
    - 3) Engine generator exhaust piping and muffler.
  - d. Paint electrical conduits containing cables rated 600 volts or more using two coats of MPI 9 (Exterior Alkyd Enamel (EO), MPI 8 (Exterior Alkyd, Flat (EO) or MPI 94 (Exterior Alkyd, Semi-gloss (EO) in the Federal Safety Orange color in exposed and concealed spaces full length of conduit.
2. Other exposed locations:
- a. Metal surfaces, except aluminum, of cooling towers exposed to view, including connected pipes, rails, and ladders: Two coats of MPI 1 (Aluminum Paint (AP)).

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- b. Cloth jackets of insulation of ducts and pipes in connection with plumbing, air conditioning, ventilating refrigeration and heating systems: One coat of MPI 50 (Interior Latex Primer Sealer) and one coat of MPI 10 (Exterior Latex, Flat or MPI 11 (Exterior Latex Semi-Gloss (AE))).

**3.10 BUILDING AND STRUCTURAL WORK FIELD PAINTING**

- A. Painting and finishing of interior and exterior work except as specified under paragraph 3.11 B.
  - 1. Painting and finishing of new and existing work including colors and gloss of finish selected is specified in Finish Schedule.
  - 2. Painting of disturbed, damaged and repaired or patched surfaces when entire space is not scheduled for complete repainting or refinishing.
  - 3. Painting of ferrous metal and galvanized metal.
  - 4. Painting of wood with fire retardant paint exposed in attics, when used as mechanical equipment space except shingles.
  - 5. Identity painting and safety painting.
- B. Building and Structural Work not Painted:
  - 1. Prefinished items:
    - a. Casework, doors, elevator entrances and cabs, metal panels, wall covering, and similar items specified factory finished under other sections.
    - b. Factory finished equipment and pre-engineered metal building components such as metal roof and wall panels.
  - 2. Finished surfaces:
    - a. Hardware except ferrous metal.
    - b. Anodized aluminum, stainless steel, chromium plating, copper, and brass, except as otherwise specified.
    - c. Signs, fixtures, and other similar items integrally finished.
  - 3. Concealed surfaces:
    - a. Inside dumbwaiter, elevator and duct shafts, interstitial spaces, pipe basements, crawl spaces, pipe tunnels, above

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- ceilings, attics, except as otherwise specified.
- b. Inside walls or other spaces behind access doors or panels.
- c. Surfaces concealed behind permanently installed casework and equipment.
- 4. Moving and operating parts:
  - a. Shafts, chains, gears, mechanical and electrical operators, linkages, and sprinkler heads, and sensing devices.
  - b. Tracks for overhead or coiling doors, shutters, and grilles.
- 5. Labels:
  - a. Code required label, such as Underwriters Laboratories Inc., Inchcape Testing Services, Inc., or Factory Mutual Research Corporation.
  - b. Identification plates, instruction plates, performance rating, and nomenclature.
- 6. Galvanized metal:
  - a. Exterior chain link fence and gates, corrugated metal areaways, and gratings.
  - b. Gas Storage Racks.
  - c. Except where specifically specified to be painted.
- 7. Metal safety treads and nosings.
- 8. Gaskets.
- 9. Concrete curbs, gutters, pavements, retaining walls, exterior exposed foundation walls and interior walls in pipe basements.
- 10. Face brick.
- 11. Structural steel encased in concrete, masonry, or other enclosure.
- 12. Structural steel to receive sprayed-on fire proofing.
- 13. Ceilings, walls, columns in interstitial spaces.
- 14. Ceilings, walls, and columns in pipe basements.

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**3.11 IDENTITY PAINTING SCHEDULE**

A. Identify designated service in accordance with ANSI A13.1, unless specified otherwise, on exposed piping, piping above removable ceilings, piping in accessible pipe spaces, interstitial spaces, and piping behind access panels.

1. Legend may be identified using 2.1 G options or by stencil applications.
2. Apply legends adjacent to changes in direction, on branches, where pipes pass through walls or floors, adjacent to operating accessories such as valves, regulators, strainers and cleanouts a minimum of 12000 mm (40 feet) apart on straight runs of piping. Identification next to plumbing fixtures is not required.
3. Locate Legends clearly visible from operating position.
4. Use arrow to indicate direction of flow.
5. Identify pipe contents with sufficient additional details such as temperature, pressure, and contents to identify possible hazard. Insert working pressure shown on drawings where asterisk appears for High, Medium, and Low Pressure designations as follows:
  - a. High Pressure - 414 kPa (60 psig) and above.
  - b. Medium Pressure - 104 to 413 kPa (15 to 59 psig).
  - c. Low Pressure - 103 kPa (14 psig) and below.
  - d. Add Fuel oil grade numbers.
6. Legend name in full or in abbreviated form as follows:

	COLOR OF EXPOSED ABBREVIATIONS	COLOR OF BACK- GROUND	COLOR OF LETTERS	LEGEND
PIPING	PIPING	GROUND		
Blow-off		Yellow	Black	Blow-off
Boiler Feedwater		Yellow	Black	Blr Feed
A/C Condenser Water Supply		Green	White	A/C Cond Wtr
Sup				

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A/C Condenser Water Return Ret	Green	White	A/C Cond Wtr
Chilled Water Supply	Green	White	Ch. Wtr Sup
Chilled Water Return	Green	White	Ch. Wtr Ret
Shop Compressed Air	Yellow	Black	Shop Air
Air-Instrument Controls Cont	Green	White	Air-Inst
Drain Line	Green	White	Drain
Emergency Shower	Green	White	Emg Shower
High Pressure Steam	Yellow	Black	H.P. _____*
High Pressure Condensate Return _____*	Yellow	Black	H.P. Ret
Medium Pressure Steam _____*	Yellow	Black	M. P. Stm
Medium Pressure Condensate Return _____*	Yellow	Black	M.P. Ret
Low Pressure Steam _____*	Yellow	Black	L.P. Stm
Low Pressure Condensate Return _____*	Yellow	Black	L.P. Ret
High Temperature Water Supply Sup	Yellow	Black	H. Temp Wtr
High Temperature Water Return Ret	Yellow	Black	H. Temp Wtr
Hot Water Heating Supply	Yellow	Black	H. W. Htg Sup
Hot Water Heating Return	Yellow	Black	H. W. Htg Ret
Gravity Condensate Return Ret	Yellow	Black	Gravity Cond
Pumped Condensate Return Ret	Yellow	Black	Pumped Cond
Vacuum Condensate Return	Yellow	Black	Vac Cond Ret
Fuel Oil - Grade Oil-Grade __*	Green	White	Fuel
Boiler Water Sampling	Yellow	Black	Sample
Chemical Feed	Yellow	Black	Chem Feed
Continuous Blow-Down	Yellow	Black	Cont. B D
Pumped Condensate		Black	Pump Cond



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Pump Recirculating		Yellow	Black	
		Pump-Recirc.		
Vent Line		Yellow	Black	Vent
Alkali				
		Yellow		Black Alk
Bleach		Yellow	Black	Bleach
Detergent		Yellow	Black	Det
Liquid Supply		Yellow	Black	Liq Sup
Reuse Water		Yellow	Black	Reuse Wtr
Cold Water (Domestic)	White	Green	White	C.W. Dom
Hot Water (Domestic)				
Supply	White	Yellow	Black	H.W. Dom
Return	White	Yellow	Black	H.W. Dom Ret
Tempered Water	White	Yellow	Black	Temp. Wtr
Ice Water				
Supply	White	Green	White	Ice Wtr
Return	White	Green	White	Ice Wtr Ret
Reagent Grade Water		Green	White	RG
Reverse Osmosis		Green	White	RO
Sanitary Waste		Green	White	San Waste
Sanitary Vent		Green	White	San Vent
Storm Drainage		Green	White	St Drain
Pump Drainage		Green	White	Pump Disch
Chemical Resistant Pipe				
Waste		Yellow	Black	Acid Waste
Vent		Yellow	Black	Acid Vent
Atmospheric Vent		Green	White	ATV
Silver Recovery		Green	White	Silver Rec
Oral Evacuation		Green	White	Oral Evac
Fuel Gas		Yellow	Black	Gas
Fire Protection Water				
Sprinkler		Red	White	Auto Spr
Standpipe		Red	White	Stand
Sprinkler		Red	White	Drain

7. Electrical Conduits containing feeders over 600 volts, paint legends using 50 mm (2 inch) high black numbers and letters, showing the voltage class rating. Provide legends where conduits pass

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through walls and floors and at maximum 6100 mm (20 foot) intervals in between. Use labels with yellow background with black border and words Danger High Voltage Class, 5000, 15000, or 25000.

8. See Sections for methods of identification, legends, and abbreviations of the following:

- a. Conduits containing high voltage feeders over 600 volts:

Section 26 05 33, RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS and  
Section 27 05 33, RACEWAYS AND BOXES FOR COMMUNICATIONS SYSTEMS.

**B. Fire and Smoke Partitions:**

1. Identify partitions above ceilings on both sides of partitions except within shafts in letters not less than 64 mm (2 1/2 inches) high.
2. Stenciled message: "SMOKE BARRIER" or, "FIRE BARRIER" as applicable.
3. Locate not more than 6100 mm (20 feet) on center on corridor sides of partitions, and with a least one message per room on room side of partition.
4. Use semigloss paint of color that contrasts with color of substrate.

**C. Identify columns in pipe basements and interstitial space:**

1. Apply stenciled number and letters to correspond with grid numbering and lettering shown.
2. Paint numbers and letters 100 mm (4 inches) high, locate 450 mm (18 inches) below overhead structural slab.
3. Apply on four sides of interior columns and on inside face only of exterior wall columns.
4. Color:
  - a. Use black on concrete columns.
  - b. Use white or contrasting color on steel columns.

**3.12 PROTECTION CLEAN UP, AND TOUCH-UP**

- A. Protect work from paint droppings and spattering by use of masking, drop cloths, removal of items or by other approved methods.

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- B. Upon completion, clean paint from hardware, glass and other surfaces and items not required to be painted of paint drops or smears.
- C. Before final inspection, touch-up or refinished in a manner to produce solid even color and finish texture, free from defects in work which was damaged or discolored.

- - - E N D - - -

APPENDIX

Paint or coating	Abbreviation
Acrylic Emulsion	AE (MPI 10 - flat/MPI 11 - semigloss/MPI 119 - gloss)
Alkyd Flat	Ak (MPI 49)
Alkyd Gloss Enamel	G (MPI 48)
Alkyd Semigloss Enamel	SG (MPI 47)
Aluminum Paint	AP (MPI 1)
Cementitious Paint	CEP (TT-P-1411)
Exterior Latex	EL??(MPI 10 / 11 / 119)??
Exterior Oil	EO (MPI 9 - gloss/MPI 8 - flat/MPI 94 - semigloss)
Epoxy Coating	EC (MPI 77 - walls, floors/MPI 108 - CMU, concrete)
Fire Retardant Paint	FR (MPI 67)
Fire Retardant Coating (Clear)	FC (MPI 66, intumescent type)
Floor Enamel	FE (MPI 27 - gloss/MPI 59 - eggshell)
Heat Resistant Paint	HR (MPI 22)
Latex Emulsion	LE (MPI 53, flat/MPI 52, eggshell/MPI 54, semigloss/MPI 114, gloss Level 6)
Latex Flat	LF (MPI 138)
Latex Gloss	LG (MPI 114)
Latex Semigloss	SG (MPI 141)
Latex Low Luster	LL (MPI 139)
Plastic Floor Coating	PL
Polyurethane Varnish	PV (MPI 31 - gloss/MPI 71 - flat)
Rubber Paint	RF (CID-A-A-3120 - Paint for Swimming Pools (RF)).

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Water Paint, Cement

WPC (CID-A-A-1555 - Water Paint, Powder).

Wood Stain

WS (MPI 90)

- - - E N D - - -

SECTION 10 14 00

SIGNAGE

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This section specifies interior signage for room numbers, directional signs, code required signs, telephone identification signs and temporary interior signs.

1.2 RELATED WORK

- A. Lighted EXIT signs for egress purposes are specified under Division 26, ELECTRICAL.

1.3 MANUFACTURER'S QUALIFICATIONS

Sign manufacturer shall provide evidence that they regularly and presently manufactures signs similar to those specified in this section as one of their principal products.

1.4 SUBMITTALS

- A. Submit in accordance with Section 01 33 00, SHOP DRAWINGS, PRODUCT DATA AND SAMPLES.
- B. Samples: Sign panels and frames, with letters and symbols, each type. Submit 2 sets. One set of samples will be retained by Resident Engineer, other returned to Contractor.
  - 1. Sign Panel, 200 mm x 250 mm (8 inches x 10 inches), with letters.
  - 2. Color samples of each color, 150 mm x 150 mm (6 inches x 6 inches). Show anticipated range of color and texture.
  - 3. Sample of typeface, arrow and symbols in a typical full size layout.
- C. Manufacturer's Literature:
  - 1. Showing the methods and procedures proposed for the concealed anchorage of the signage system to each surface type.
  - 2. Manufacturer's printed specifications, anchorage details, installation and maintenance instructions.
- D. Samples: Sign location plan, showing location, type and total number of signs required.
- E. Shop Drawings: Scaled for manufacture and fabrication of sign types. Identify materials, show joints, welds, anchorage, accessory items, mounting and finishes.
- F. Full size layout patterns for dimensional letters.

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**1.5 DELIVERY AND STORAGE**

- A. Deliver materials to job in manufacturer's original sealed containers with brand name marked thereon. Protect materials from damage.
- B. Package to prevent damage or deterioration during shipment, handling, storage and installation. Maintain protective covering in place and in good repair until removal is necessary.
- C. Deliver signs only when the site and mounting services are ready for installation work to proceed.
- D. Store products in dry condition inside enclosed facilities.

**1.6 APPLICABLE PUBLICATIONS**

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.
- B. American Society for Testing and Materials (ASTM):
  - B209-07 .....Aluminum and Aluminum-Alloy Sheet and Plate
  - B221-08 .....Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Shapes, and tubes.
- C. Federal Specifications (Fed Spec):
  - MIL-PRF-8184F .....Plastic Sheet, Acrylic, Modified.
  - MIL-P-46144C .....Plastic Sheet, Polycarbonate

**1.7 MINIMUM SIGN REQUIREMENTS**

- A. Permanent Rooms and Spaces:
  - 1. Tactile and Braille Characters, raised minimum 0.793 mm (1/32 in). Characters shall be accompanied by Grade 2 Braille.
  - 2. Type Styles: Characters shall be uppercase, Helvetica Medium, Helvetica Medium Condensed and Helvetica Regular.
  - 3. Character Height: Minimum 16 mm (5/8 in) high, Maximum 50 mm (2 in).
  - 4. Symbols (Pictograms): Equivalent written description shall be placed directly below symbol, outside of symbol's background field. Border dimensions of symbol background shall be minimum 150 mm (6 in) high.
  - 5. Finish and Contrast: Characters and background shall be eggshell, matte or other non-glare finish with adequate contrast with background.
  - 6. Mounting Location and Height: As shown. Mounted on wall adjacent to the latch side of the door and to avoid door swing and protruding objects.

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**B. Overhead Signs:**

1. Type Styles: As shown. Characters shall have a width-to-height ratio between 3:5 and 1:1. Characters shall have a stroke width-to-height ratio of between 1:5 and 1:10.
2. Character Height: minimum 75 mm (3 in) high for overhead signs. As shown, for directional signs.
3. Finish and Contrast: Same as for signs of permanent rooms and spaces.
4. Mounting Location and Height: As shown.

**1.8 COLORS AND FINISHES:**

Refer to Finish Schedule and Wayfinding General Notes.

**PART 2 - PRODUCTS**

**2.1 GENERAL**

- A. Signs of type, size and design shown on the drawings and as specified.
- B. Signs complete with lettering, framing and related components for a complete installation.
- C. Provide graphics items as completed units produced by a single manufacturer, including necessary mounting accessories, fittings and fastenings.
- D. Do not scale drawings for dimensions. Contractor to verify and be responsible for all dimensions and conditions shown by these drawings. Resident Engineer to be notified of any discrepancy in drawing, in field directions or conditions, and/or of any changes required for all such construction details.
- E. The Sign Contractor, by commencing work of this section, assumes overall responsibility, as part of his warranty of work, to assure that assemblies, components and parts shown or required within the work of the section, comply with the Contract Documents. The Contractor shall further warrant: That all components, specified or required to satisfactorily complete the installation are compatible with each other and with conditions of installations.

**2.2 PRODUCTS**

- A. Aluminum:
  1. Sheet and Plate: ASTM B209.
  2. Extrusions and Tubing: ASTM B221.
- B. Cast Acrylic Sheet: MIL-PRF-8184F; Type II, class 1, Water white non-glare optically clear. Matt finish water white clear acrylic shall not be acceptable.

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- C. Polycarbonate: MIL-P-46144C; Type I, class 1.
- D. Vinyl: 0.1 mm thick machine cut, having a pressure sensitive adhesive and integral colors.
- E. Film: Light management film, 3 mm thick, black.

**2.3 SIGN STANDARDS**

- A. Topography:
  - 1. Type Style: Helvetica Bold, Helvetica Regular and Helvetica Bold Condensed. Initial caps or all caps as indicated in Sign Message Schedule.
  - 2. Arrow: See graphic standards in drawings.
  - 3. Letter spacing: Refer to VA Signage Design Guide unless otherwise indicated in drawings.
  - 4. All text, arrows, and symbols to be provided in size, colors, typefaces and letter spacing shown. Text shall be a true, clean, accurate reproduction of typeface(s) shown. Text shown in drawings are for layout purposes only; final text for signs is listed in Sign Message Schedule.
- B. Project Colors and Finishes: See Finish Schedule and Wayfinding General Notes.

**2.4 SIGN TYPES**

- A. General:
  - 1. The interior sign system is comprised of sign types families that are identified by a letter and number which identify a particular group of signs. An additional number identifies a specific type of sign within that family.
- a. IN indicates a component construction based sign.
  - 1. The exterior sign system shall be comprised of sign types families that are identified by a letter and number which identify a particular group of signs. An additional number identifies a specific type of sign within that family.
  - 2. EI designation indicates exterior internally illuminated sign.
  - 3. EN designation indicates exterior non-illuminated sign.
- B. Interchangeable Component System:
  - 1. Sign Type Families: 03, 04, 05, 06, 07, 08, 09 10, 11 12, 13, 14, 15, 16 and 17.
  - 2. Interior sign system capable of being arranged in a variety of configurations with a minimum of attachments, devices and connectors.



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- a. Interchangeable nature of the system shall allow for changes of graphic components of the installed sign, without changing sign in its entirety.
  - b. Component Sign System is comprised of the following primary components:
    - 1) Rail Back utilizing horizontal rails, spaced to allow for uniform, modular sizing of sign types.
    - 2) Rail Insert mounted to back of Copy Panels to allow for attachment to Rail Back.
    - 3) Copy Panels, made of a variety of materials to allow for different graphic needs.
    - 4) End Caps which interlock to Rail Back to enclose and secure changeable Copy Panels.
    - 5) Joiners and Accent Joiners connect separate Rail Backs together.
    - 6) Top Accent Bars which provide decorative trim cap that encloses the top of sign or can connect the sign to a Type 03 Room Number Sign.
  - c. Rail Back, Rail Insert and End Caps in anodized extruded aluminum to allow for tight tolerances and consistent quality of fit and finish.
  - d. Signs in system shall be convertible in the field to allow for enlargement from one size to another in height and width through use of Joiners or Accent Joiners, which connect Rail Back panels together blindly, providing a butt joint between Copy Panels. Accent Joiners shall connect Rail Backs together with a visible 3 mm (1/8") horizontal rib, flush to the adjacent copy insert surfaces.
  - e. Sign configurations shall vary in width from 225 mm (9 inches) to 2050 mm (80 inches), and have height dimensions of 50 mm (2 inches), 75 mm (3 inches), 150 mm (6 inches), 225 mm (9 inches) and 300 mm (12 inches). Height shall be increased beyond 300 mm (12 inches), by repeating height module in full or in part.
3. Rail Back functions as internal structural member of sign using 6063T5 extruded aluminum and anodized black.
    - a. Shall accept an extruded aluminum or plastic insert on one sign or on both sides, depending upon sign type.
    - b. Shall be convertible in field to allow for connection to other Rail Back panels, so that additive changes can be made to sign unit.

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- c. Rail shall allow for a variety of mounting devices including wall mounting for screw-on applications, using pressure sensitive tape, freestanding mount, ceiling mount and other mounting devices as needed.
- 4. Rail Insert functions as a mounting device for Copy Panels on to the Rail Back. The Rail Insert mounts to the back of the Copy Panel with adhesive suitable for use with the particular copy insert material.
  - a. Shall allow Copy Panels to slide or snap into the horizontal Rail Back for ease of changeability.
  - b. Shall mount to the back of the Copy Panel with adhesive suitable for use with particular Copy Panel material.
- 5. Copy Panels shall accept various forms of copy and graphics, and attaches to the Rail Back with the Rail Insert. Copy Panels shall be either ABS plastic with integral color or an acrylic lacquer finish; photo polymer; or, acrylic.
  - a. Interchangeable by sliding horizontally from either side of sign, and to other signs in system of equal or greater width or height.
  - b. Cleanable without use of special chemicals or cleaning solutions.
  - c. Copy Insert Materials.
    - 1) ABS Inserts - 2.3 mm (.090 inches) extruded ABS plastic core with .07 mm (.003 inches) acrylic cap bonded during extrusion/texturing process. Pressure bonded to extruded Rail Insert using adhesive. Background color is either integral or painted in acrylic lacquer. ABS inserts finished in a chromium industries #HM335RA texture pattern to prevent glare.
    - 2) Photo polymer Inserts - 3 mm (.125 inches) phenolic photo polymer with raised copy etched to 2.3 mm (.0937 inches), bonded to an ABS plastic or extruded aluminum insert with adhesive. Background color is painted in acrylic enamel.
    - 3) Changeable Paper/ Insert Holder - Extruded insert holder with integral Rail Insert for connection with structural back panel in 6063T5 aluminum with a black anodized finish. Inserts into holder are paper with a clear 0.7 mm (.030 inches) textured cover. Background color is painted in acrylic lacquer.
    - 4) Acrylic - 2 mm (.080 inches) non-glare acrylic. Pressure bonded to extruded Rail Insert using adhesive. Background color is painted in acrylic lacquer or acrylic enamel.
    - 5) Extruded 6063T5 aluminum with a black anodized finish Insert Holder with integral Rail Insert for connection with Structural Back Panel to hold a 0.7 mm (.030 inches) textured

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polycarbonate insert and a Sliding Tile which mounts in the Inset Holder and slides horizontally.

- 6) End Caps - Extruded using 6063T5 aluminum with a black anodized. End Caps interlock with Rail Back with clips to form an integral unit, enclosing and securing the changeable Copy Panels, without requiring tools for assembly.
  - a) Shall be interchangeable to either end of sign and to other signs in the system of equal height.
  - b) Mechanical fasteners can be added to the End Caps that will secure it to Rail Back to make sign tamper resistant.
- 7) Joiners - Extruded using 6063T5 aluminum with a black anodized finish. Rail Joiners connect Rail Backs together blindly, providing a butt joint between Copy Inserts.
- 8) Accent Joiners - Extruded using 6063T5 aluminum with a mirror polished finish. Joiner shall connect Rail Backs together with a visible 3 mm (.125 inches) horizontal rib, flush to the adjacent Copy Panel surfaces.
- 9) Top Accent Rail - Extruded using 6063T5 aluminum with a mirror polished finish. Rail shall provide 3 mm (.125 inches) high decorative trim cap, which butts flush to adjacent Copy Panel and encloses top of Rail Back and Copy Panel.
- 10) Typography
  - a) Vinyl First Surface Copy (non-tactile) - Applied Vinyl copy.
  - b) Subsurface Copy Inserts - Textured 1 mm (.030 inches) clear polycarbonate face with subsurface applied Vinyl copy. Face shall be back sprayed with paint and laminated to an extruded aluminum carrier insert.
  - c) Integral Tactile Copy Inserts - phenolic photo polymer etched with 2.3 mm (.0937 inches) raised copy.
  - d) Silk-screened First Surface Copy (non-tactile) - Injection molded or extruded ABS plastic or aluminum insert with first surface applied enamel silk-screened copy.

**C. Sign Type Family 01, 02.01 thru 02.05, 08, 09 and 20:**

1. All text and graphics are to be first surface silk-screened.
2. IN-01.12 & IN-01.13: Refer to Sign Type 03 specification for tactile and Braille portion of sign.
3. IN-02.4: All text and graphics are to be first surface vinyl letters.
4. IN-01.1: Preparation of artwork for reproduction of "fire and emergency evacuation maps" is by manufacturer.

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D. Sign Type Families 03:

1. Tactile sign is to be made from a material that provides for letters, numbers and Braille to be integral with sign plaque material such as: photosensitive polyamide resin, etched metal, sandblasted phenolic or embossed material. Do not apply letters, numbers and Braille with adhesive.
2. Numbers, letters and Braille to be raised 0.793 mm (.0312 inches) from the background surface. The draft of the letters, numbers and Braille to be tapered, vertical and clean.
3. Braille dots are to conform with standard dimensions for literary Braille; (a) Dot base diameter: 1.5 mm (.059 inches) (b) Inter-dot spacing: 2.3 mm (.090 inches) (c) Horizontal separation between cells: 6.0 mm (.241 inches) (d) Vertical separation between cells: 10.0 mm (.395 inches)
4. Entire assembly is painted in specified color. After painting, apply white or other specified color to surface of the numbers and letters. Entire sign is to have a protective clear coat sealant applied.
5. Complete sign is to have an eggshell finish (11 to 19 degree on a 60 degree glossmeter).

E. Sign Type Family 04 and 11:

1. All text and graphics are to be first surface applied vinyl letters.
2. IN-04: When a Type IN-04 is to be mounted under a Type IN03, a connecting Accent Joiner is to be used to create a singular integrated sign.

F. Sign Type 05:

1. Text if added to Copy Insert module to be first surface applied vinyl letters.

G. Sign Type Family 06 and 07:

1. All text and graphics are to be first surface applied vinyl letters except for under sliding tile.
2. Protect text, which is covered by sliding tile, so tile does not wear away letters.

H. Sign Type Family 10:

1. Pocket depth is to be 0.3 mm (.0150 inches).

I. Sign Type Family 12 and 13:

1. All text and graphics are to be first surface applied vinyl letters.
2. IN-12: Provide felt, cork or similar material on bottom of desk mounting bracket to protect counter surfaces.

J. Sign Type Family 14, 15, and 16:

1. All text and graphics are to be first surface applied vinyl letters.

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2. IN-14.06: When added to top of IN-14.01, IN-14.04, or IN-14.05 a connecting Accent Joiner is to be used to create a singular integrated sign.
3. Ceiling mounted signs required mounting hardware on the sign that allows for sign disconnection, removal and reinstallation and reconnection.

**K. Sign Type Family 17:**

1. All text and graphics are to be first surface applied vinyl letters.
2. IN-17: Directory constructed using elements of the Component System.

**L. Sign Type Family 18:**

1. All text and graphics are to be first surface applied stylus cut vinyl letters.
2. Provide in specified typeface, color and spacing, with each message or message group on a single quick release backing sheet.

**M. Sign Type Family 19:**

1. Dimensional letters are mill or laser cut acrylic in the size and thickness noted in the drawings.
2. Draft of letters is perpendicular to letters face.
3. All corners such as where a letter stem and bar intersect are to be square so the letter form is accurately reproduced.
4. Paint letters with acrylic polyurethane in specified color and finish.

**P. Temporary Interior Signs:**

1. Fabricated from 50 kg (110 pound) matte finished white paper cut to 100 mm (4 inch) wide by 300 mm (12 inch) long. Punched 3 mm (.125 inch) hole with edge of hole spaced 13 mm (.5 inch) in from edge and centered on 100 mm (4 inch) side. Reinforce hole on both sides with suitable material that prevents tie from pulling through hole. Ties are steel wire 0.3 mm (0.120 inch) thick attached to tag with twist leaving 150 mm (6 inch) long free ends.
2. Mark architectural room number on sign, with broad felt marker in clearly legible numbers or letters that identify room, corridor or space as shown on floor plans.
3. Install temporary signs to all rooms that have a room, corridor or space number. Attach to door frame, door knob or door pull.
  - a. Doors that do not require signs are: corridor doors in corridor with same number, folding doors or partitions, toilet doors, bathroom doors within and between rooms, closet doors within rooms, communicating doors in partitions between rooms with corridor entrance doors.

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b. Replace and missing damaged or illegible signs.

**2.5 FABRICATION**

- A. Design components to allow for expansion and contraction for a minimum material temperature range of 56 °C (100 °F), without causing buckling, excessive opening of joints or over stressing of adhesives, welds and fasteners.
- B. Form work to required shapes and sizes, with true curve lines and angles. Provide necessary rebates, lugs and brackets for assembly of units. Use concealed fasteners whenever and wherever possible.
- C. Shop fabricate so far as practicable. Joints fastened flush to conceal reinforcement, or welded where thickness or section permits.
- D. Contact surfaces of connected members be true. Assembled so joints will be tight and practically unnoticeable, without use of filling compound.
- E. Signs shall have fine, even texture and be flat and sound. Lines and miters sharp, arises unbroken, profiles accurate and ornament true to pattern. Plane surfaces be smooth flat and without oil-canning, free of rack and twist. Maximum variation from plane of surface plus or minus 0.3 mm (0.015 inches). Restore texture to filed or cut areas.
- F. Level or straighten wrought work. Members shall have sharp lines and angles and smooth surfaces.
- G. Extruded members to be free from extrusion marks. Square turns and corners sharp, curves true.
- H. Drill holes for bolts and screws. Conceal fastenings where possible. Exposed ends and edges mill smooth, with corners slightly rounded. Form joints exposed to weather to exclude water.
- I. Finish hollow signs with matching material on all faces, tops, bottoms and ends. Edge joints tightly mitered to give appearance of solid material.
- J. All painted surfaces properly primed. Finish coating of paint to have complete coverage with no light or thin applications allowing substrate or primer to show. Finished surface smooth, free of scratches, gouges, drips, bubbles, thickness variations, foreign matter and other imperfections.
- K. Movable parts, including hardware, are be cleaned and adjusted to operate as designed without binding or deformation of members. Doors and covers centered in opening or frame. All contact surfaces fit tight and even without forcing or warping components.
- L. Pre-assemble items in shop to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping

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and handling limitations. Clearly mark units for re-assembly and coordinated installation.

- M. No signs are to be manufactured until final sign message schedule and location review has been completed by the Resident Engineer & forwarded to contractor.

**PART 3 - EXECUTION**

**3.1 INSTALLATION**

- A. Protect products against damage during field handling and installation. Protect adjacent existing and newly placed construction, landscaping and finishes as necessary to prevent damage during installation. Paint and touch up any exposed fasteners and connecting hardware to match color and finish of surrounding surface.
- B. Mount signs in proper alignment, level and plumb according to the sign location plan and the dimensions given on elevation and sign location drawings. Where otherwise not dimensioned, signs shall be installed where best suited to provide a consistent appearance throughout the project. When exact position, angle, height or location is in doubt, contact Resident Engineer for clarification.
- C. Contractor shall be responsible for all signs that are damaged, lost or stolen while materials are on the job site and up until the completion and final acceptance of the job.
- D. Remove or correct signs or installation work Resident Engineer determines as unsafe or as an unsafe condition.
- E. At completion of sign installation, clean exposed sign surfaces. Clean and repair any adjoining surfaces and landscaping that became soiled or damaged as a result of installation of signs.
- F. Locate signs as shown on the Sign Location Plans.
- G. Certain signs may be installed on glass. A blank glass back up is required to be placed on opposite side of glass exactly behind sign being installed. This blank glass back up is to be the same size as sign being installed.
- H. Contractor will be responsible for verifying that behind each sign location there are no utility lines that will be affected by installation of signs. Any damage during installation of signs to utilities will be the sole responsibility of the Contractor to correct and repair.
- I. Furnish inserts and anchoring devices which must be set in concrete or other material for installation of signs. Provide setting drawings,

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templates, instructions and directions for installation of anchorage  
devices which may involve other trades.

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SECTION 10 21 13

TOILET COMPARTMENTS

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This section specifies solid polyethylene toilet partitions.

1.2 RELATED WORK

- A. Overhead structural steel supports for ceiling hung pilasters:  
Section 05 50 00, METAL FABRICATIONS.
- B. Grab bars and toilet tissue holders: Section 10 28 00, TOILET, BATH,  
AND LAUNDRY ACCESSORIES.

1.3 SUBMITTALS

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT  
DATA, AND SAMPLES.
- B. Manufacturer's Literature and Data: Specified items indicating all  
hardware and fittings, material, finish, and latching.
- C. Shop Drawings: Construction details at 1/2 scale, showing  
installation details, anchoring and leveling devices.
- D. Manufacturer's certificate, attesting that zinc-coatings conform to  
specified requirements.

1.4 APPLICABLE PUBLICATIONS

- A. Publications listed below form a part of this specification to the  
extent referenced. Publications are referenced in the text by the  
basic designation only.
- B. Federal Specifications (Fed. Spec.):
1. FF-B-575C Bolt, Hexagon and Square
- C. Code of Federal Regulations (CFR):
1. 40 CFR 247 Comprehensive Procurement Guidelines for Products  
Containing Recovered Materials

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D. Commercial Item Descriptions (CID):

1. A-A-1925 Shield, Expansion (Nail Anchors)
2. A-A-60003           Partitions, Toilet, Complete

**PART 2 - PRODUCTS**

**2.1 TOILET PARTITIONS:**

- A. Solid phenolic: water resistant; graffiti resistant; non-absorbent; contain a minimum 30 percent post consumer recycled plastic; Class C flame spread rating.
- B. Conform to Fed. CID A-A-60003, except as modified herein.
- C. Fabricate to dimensions shown or specified.
- D. Toilet Enclosures:
  1. Type 1, Style B (Ceiling hung) .
  2. Reinforce panels shown to receive toilet tissue holders or grab bars.
  3. Upper pivots and lower hinges adjustable to hold doors open 30 degrees.
  4. Latching devices and hinges for handicap compartments shall comply with ADA requirements.
  5. Keeper:
    - a. U-slot to engage bar of throw latch.
    - b. Combined with rubber bumper stop.
  6. Wheelchair Toilets:
    - a. Upper pivots and lower hinges to hold out swinging doors in closed position.
    - b. Provide U-type doors pulls, approximately 100 mm (four inches) long on pull side.
  7. Finish: Color as indicated in Finish Legend.

**2.2 FASTENERS**

- A. Partition Fasteners: CID A-A-60003.

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- B. Use expansion bolts, CID A-A-60003, for anchoring to solid masonry or concrete.
- C. Use toggle bolts, CID A-A-60003, for anchoring to hollow masonry or stud framed walls.
- D. Use steel bolts FS-B-575, for anchoring pilasters to overhead steel supports.

**PART 3 - EXECUTION**

**3.1 INSTALLATION**

A. General:

- 1. Install in rigid manner, straight, plumb and with all horizontal lines level.
- 2. Conceal evidence of drilling, cutting and fitting in finish work.
- 3. Use hex-bolts for through-bolting.
- 4. Adjust hardware and leave in freely working order.
- 5. Clean finished surfaces and leave free of imperfections.

B. Panels and Pilasters:

- 1. Support panels, except urinal screens, and pilaster abutting building walls near top and bottom by stirrup supports secured to partitions with through-bolts.
- 2. Secure stirrups to walls with two suitable anchoring devices for each stirrup.
- 3. Secure panels to faces of pilaster near top and bottom with stirrup supports, through-bolted to panels and machine screwed to each pilaster.
- 4. Secure edges of panels to edges of pilasters near top and bottom with "U" shaped brackets.

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SECTION 10 21 23

CUBICLE CURTAIN TRACKS

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This section specifies cubicle curtain track (C.C.T.) and intravenous support assembly (I.V).

1.2 RELATED WORK

- A. Steel shapes for suspending track assembly: Section 05 50 00, METAL FABRICATIONS and Section 09 51 00, ACOUSTICAL CEILINGS.

1.3 SUBMITTALS

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Samples:
  - 1. One 300 mm (12 inch) long piece of cubicle curtain track with carrier access and end stop.
  - 2. One clip anchor for fastening track to grid system of acoustical ceilings. One curtain carrier.
  - 3. One intravenous support assembly consisting 300 mm (12 inch) long pieces of track, carrier assembly, and bottle pendant.
- C. Shop Drawings: Showing layout of tracks and method of anchorage.
- D. Manufacturer's Literature and Data:
  - 1. Cubicle curtain track.
  - 2. Intravenous support assembly.

1.4 DELIVERY, STORAGE AND HANDLING

- A. Deliver material in original package marked to identify the contents, brand name, and the name of the manufacturer or supplier.
- B. Store in dry and protected location. Store so as to not bend or warp the tracks.

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- C. Do not open packages until contents are needed for installation, unless verification inspection is required.

**1.5 APPLICABLE PUBLICATIONS**

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.
- B. American Society for Testing and Materials (ASTM):
  - 1. B221-08 Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Shapes, and Tubes.
  - 2. B456-03(R2009) Electrodeposited Coatings for Copper Plus Nickel Plus Chromium and Nickel Plus Chromium
- C. The National Association of Architectural Metal Manufacturers (NAAMM):
  - 1. AMP 500 Series Metal Finishes Manual

**PART 2 - PRODUCTS**

**2.1 CUBICLE CURTAIN TRACKS**

- A. Surface Mounted and Suspended Type:
  - 1. Channel Tracks (Surface Mounted Type): Extruded aluminum, ASTM B221, alloy 6063, temper T5 or T6, channel shaped, with smooth inside raceway for curtain carriers.
  - 2. Tubular Track (Suspended Type): Seamless drawn aluminum tubing, ASTM B221, alloy 6061 temper T6, 25 mm (one inch) outside diameter, not less than 1.5 mm (0.060 inch) wall thickness, slotted for interior carriers.
- B. Curtain Carriers: Nylon or delrin carriers, with either nylon or delrin wheels on metal, delrin, or nylon axles. Equip each carrier with either stainless steel, chromium plated brass or steel hooks with swivel, or nickel chromium plated brass or stainless steel bead chain and hook assembly, or delrin carriers may have moulded on delrin hooks. Hook for bead chain may be the same material and finish as the bead chain or may be chromium plated steel. Provide 2.2 carriers for every

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300 mm (onefoot) of each section of each track length, plus one additional carrier.

- C. End Stop Connectors, Ceiling Flanges and Other Accessories: Fabricate from the same material with the same finish as the tracks or from nylon.
- D. Hangers and Fittings: Fabricate from the same material with the same finish as the tracks. Hangers may be round or square for channel tracks and round for tubular tracks. Design fittings to be compatible with design of tracks and to safely transmit the track load to the hangers.
- E. At end of each section of track, make provision for insertion and removal of carriers. Design to prevent accidental removal of carrier. Any operating mechanism shall be removable with common tools.

**2.2 INTRAVENOUS SUPPORT ASSEMBLY**

- A. Assembly includes track, carrier assembly, bottle holding pendant, curved track sections and curved connectors, and all components and accessories required for a working installation.
- B. Track: Surface mounted channel or "I" beam shaped, extruded aluminum. Equip track with removable section at splicing clamp for carrier removal. Overall size of track shall be as shown on drawings.
- C. Carrier Assembly: Assembly shall include a body made of either stainless steel or aluminum, and be equipped with four ball bearing nylon wheels and lockstop to insure insulation of carrier from track. Equip carrier with a positive locking device to hold carrier stationary when in use. Provide with either a stainless steel, or chromium plated brass hook for support of bottle holding pendent.
- D. Bottle Holding Pendent: Equip with a minimum of three, stainless steel, chromium plated steel, or chromium plated brass arms connected to adjustable shaft of same material. Adjustable shaft shall permit bottle holding hub to adjust from full height to approximately 1800 mm (six feet), 75 mm (three inches) above finished floor. Provide shaft with a built-in locking device for vertical height adjustments. Locking device shall be activated by push button or similar easily operated one hand control.

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**2.3 FASTENERS**

- A. Concealed Fasteners, Screws and Bolts: Hot-dip galvanized (except in high moisture areas use stainless steel).
- B. Metal Clips: Anchor curtain tracks to exposed grid of lay-in acoustical tile ceilings, with concealed metal (butterfly) type or two piece snap locking type ceiling clip of high strength spring steel. When it is not possible to install the metal ceiling clip, the cubicle curtain track may be screwed to the ceiling grid.

**2.4 FINISHES**

- A. Aluminum: Chemically etched medium matte, with clear anodic coating, Class II Architectural, 0.4 mils thick.
- B. Chrome/Nickel Plating: Satin or polished finish as specified, ASTM B546, minimum thickness of chromium plate as follows:
  - 1. 0.4 mil on steel.
- C. Stainless Steel: No. 4 in accordance with NAAMM Metal Finishes Manual.

**2.5 FABRICATION**

- A. Weld and grind smooth joints of fabricated components.
- B. Form tracks and bends of lengths that will produce the minimum number of joints. Make track sections up to 4800 mm (16 feet) without joints. Form corner bend on a 300 mm (12 inch) radius.
- C. Provide steel anchor plates, supports, and anchors for securing components to building construction.
- D. Form flat surface without distortion.
- E. Shop assemble components and package complete with anchors and fittings.

**PART 3 - EXECUTION**

**3.1 INSTALLATION**

- A. Install tracks after finish painting and ceiling finishing operations are complete.



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- B. Install track level and hangers plumb and securely anchor to the ceiling or suspend from above to form a rigid installation.
- C. Anchor surface mounted curtain tracks directly to exposed grid of lay-in acoustical tile ceilings with suitable fasteners, spaced approximately 600 mm (24 inches) on center.
- D. Anchor surface mounted curtain tracks to concrete, plaster and gypsum board ceilings with a minimum of 3 mm (1/8-inch) diameter fastenings or concealed clips spaced not more than 900 mm (three feet) on center.
- E. Install suspended track seven feet, three inches above the finished floor, with hangers spaced no more than four feet on center. At ceiling line, provide flange fittings secured to hangers with set screws. Secure track to walls with flanged fittings and to hangers with special fittings.
- F. Securely fasten end stop caps to prevent their being forced out by the striking weight of carriers.
- G. Anchor surface mounted intravenous track directly to support system above ceiling as shown.
- H. Remove damaged or defective components and replace with new components or repair to the original condition.

**3.2 ACCEPTANCE**

- A. Track shall be installed neat, rigid, plumb, level and true, and securely anchored to the overhead construction.
- B. Carrier units shall operate smoothly and easily over the full range of travel.

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SECTION 10 26 00

WALL AND DOOR PROTECTION

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This section specifies corner guards and wall protection sheet.

1.2 RELATED WORK

- A. Armor plates and kick plates not specified in this section: Section 08 71 00, DOOR HARDWARE.
- B. Color and texture of resilient material: Finish Schedule.

1.3 SUBMITTALS

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Shop Drawings: Show design and installation details.
- C. Manufacturer's Literature and Data:
  - 1. Corner Guards.
  - 2. Wall Protection Sheet.

1.4 DELIVERY AND STORAGE

- A. Deliver materials to the site in original sealed packages or containers marked with the name and brand, or trademark of the manufacturer.
- B. Protect from damage from handling and construction operations before, during and after installation.
- C. Store in a dry environment of approximately 21° C (70 degrees F) for at least 48 hours prior to installation.

1.5 APPLICABLE PUBLICATIONS

- A. Publications listed below form a part of this specification to extent referenced. Publications are referenced in text by basic designation only.

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B. American Society for Testing and Materials (ASTM):

1. A167-99(R2009) Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip
2. D256-06 Impact Resistance of Plastics
3. D635-06 Rate of Burning and/or Extent and Time of Burning of Self-Supporting Plastics in a Horizontal Position
4. E84-09 Surface Burning Characteristics of Building Materials

C. The National Association of Architectural Metal Manufacturers (NAAMM):

1. AMP 500-06 Metal Finishes Manual

D. Society of American Automotive Engineers (SAE):

1. J 1545-05 Instrumental Color Difference Measurement for Exterior Finishes.

E. Underwriters Laboratories Inc. (UL):

1. Annual Issue Building Materials Directory

**PART 2 - PRODUCTS**

**2.1 MATERIALS**

A. Stainless Steel: ASTM A167, Type 302B.

B. Solid Polymer Material:

1. Composition of acrylic polymer and alumina trihydrate (ATH) or similar solid surfacing composition.
2. Performance properties required:

Property	Result	Test
Elongation	0.4% min.	ASTM D638
Hardness	85 Rockwell M	ASTM D785
Impact resistance	No fracture	NEMA LD-3 900 mm (36") drop 1 kg (2 lb.) ball

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Boiling water	No visible change	NEMA LD3
surface resistance		
High temperature	Slight surface dulling	NEMA LD3

3. Cast into sheet form and bowl form.
4. Color throughout with subtle veining through thickness.
5. Joint adhesive and sealer: Manufacturers silicone adhesive and sealant for joining methyl methacrylic polymer sheet.
6. Bio-based products will be preferred.

**2.2 CORNER GUARDS**

- A. Stainless Steel Corner Guards: Fabricate of 1.6 mm (0.0625-inch) thick stainless steel. Form guards of dimensions and to contour shown.

**2.3 WALL PROTECTION SHEET**

- A. Fabricate from solid polymer designed specially for interior use; thickness as indicated on Drawings.

**2.4 FASTENERS AND ANCHORS**

- A. Provide fasteners and anchors as required for each specific type of installation.
- B. Where type, size, spacing or method of fastening is not shown or specified, submit shop drawings showing proposed installation details.

**2.5 FINISH**

- A. In accordance with NAAMM AMP 500 series.
- B. Stainless Steel: NAAMM finish Number 4.

**PART 3 - INSTALLATION**

**3.1 STAINLESS STEEL CORNER GUARDS**

- A. Mount guards on external corners of interior walls, partitions and columns as shown.

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- B. Where corner guards are installed on walls, partitions or columns finished with plaster or ceramic tile, anchor corner guards as shown on drawings.

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SECTION 10 28 00

TOILET, BATH, AND LAUNDRY ACCESSORIES

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This section specifies manufactured items usually used in dressing rooms, toilets, baths, locker rooms and at sinks in related spaces.
- B. Items Specified:
  - 1. Grab Bars.
  - 2. Metal framed mirror.
  - 3. Mop racks.
  - 4. Stainless steel shelves.
- C. This section also specifies custom fabricated items used in toilets and related spaces.

1.2 RELATED WORK

- A. Color of finishes: Finish Schedule
- B. Ceramic toilet and bath accessories: Section 09 30 13, CERAMIC TILING
- C. Custom fabricated accessories: Section 10 28 00, TOILET, BATH, AND LAUNDRY ACCESSORIES.
- D. Manufactured toilet and bath accessories: Section 10 28 00, TOILET, BATH, AND LAUNDRY ACCESSORIES.

1.3 SUBMITTALS

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Shop Drawings:
  - 1. Each product specified.
  - 2. Metal framed mirrors, showing shelf where required, fillers, and design and installation of units when installed on ceramic tile wainscots and offset surfaces.
  - 3. Grab bars, showing design and each different type of anchorage.

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4. Show material and finish, size of members, and details of construction, installation and anchorage of mop racks.

C. Samples:

1. One of each type of accessory specified.
2. After approval, samples may be used in the work.

D. Manufacturer's Literature and Data:

1. All accessories specified.
2. Show type of material, gages or metal thickness in inches, finishes, and when required, capacity of accessories.
3. Mop racks.

**1.4 QUALITY ASSURANCE**

- A. Each product shall meet, as a minimum, the requirements specified, and shall be a standard commercial product of a manufacturer regularly presently manufacturing items of type specified.
- B. Each accessory type shall be the same and be made by the same manufacturer.
- C. Each accessory shall be assembled to the greatest extent possible before delivery to the site.
- D. Include additional features, which are not specifically prohibited by this specification, but which are a part of the manufacturer's standard commercial product.

**1.5 PACKAGING AND DELIVERY**

- A. Pack accessories individually to protect finish.
- B. Deliver accessories to the project only when installation work in rooms is ready to receive them.
- C. Deliver inserts and rough-in frames to site at appropriate time for building-in.
- D. Deliver products to site in sealed packages or containers; labeled for identification with manufacturer's name, brand, and contents.



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**1.6 STORAGE**

- A. Store products in weathertight and dry storage facility.
- B. Protect from damage from handling, weather and construction operations before, during and after installation in accordance with manufacturer's instructions.

**1.7 APPLICABLE PUBLICATIONS**

- A. Publications listed below form a part of this specification to the extent referenced. Publications are referenced in the text by the basic designation only.
- B. American Society for Testing and Materials (ASTM):
  - 1. A167-99(R2009) Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet and Strip.
  - 2. A176-99(R2009) Stainless and Heat-Resisting Chromium Steel Plate, Sheet, and Strip
  - 3. A269-10 Seamless and Welded Austenitic Stainless Steel Tubing for General Service
  - 4. A312/A312M-09 Seamless and Welded Austenitic Stainless Steel Pipes
  - 5. A653/A653M-10 Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
  - 6. B221-08 Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Shapes, and Tubes
  - 7. B456-03(R2009) Electrodeposited Coatings of Copper Plus Nickel Plus Chromium and Nickel Plus Chromium
  - 8. C1036-06 Flat Glass
  - 9. C1048-04 Heat-Treated Flat Glass-Kind HS, Kind FT Coated and Uncoated Glass
  - 10. D635-10 Rate of Burning and/or Extent and Time of Burning of Self Supporting Plastics in a Horizontal Position
  - 11. F446-85(R2009) Consumer Safety Specification for Grab Bars and Accessories Installed in the Bathing Area.

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12. D3453-07 Flexible Cellular Materials - Urethane for Furniture and Automotive Cushioning, Bedding, and Similar Applications
- C. The National Association of Architectural Metal Manufacturers (NAAMM):
  1. AMP 500 Series Metal Finishes Manual
- D. American Welding Society (AWS):
  1. D10.4-86 (R2000) Welding Austenitic Chromium-Nickel Stainless Steel Piping and Tubing
- E. Federal Specifications (Fed. Specs.):
  1. A-A-3002 Mirrors, Glass
  2. FF-S-107C (2) Screw, Tapping and Drive
  3. FF-S-107C Screw, Tapping and Drive.
  4. WW-P-541E(1) Plumbing Fixtures (Accessories, Land Use) Detail Specification

**PART 2 - PRODUCTS**

**2.1 MATERIALS**

- A. Aluminum: ASTM B221, alloy 6063-T5 and alloy 6463-T5.
- B. Stainless Steel:
  1. Plate or sheet: ASTM A167, Type 302, 304, or 304L, except ASTM A176 where Type 430 is specified, 0.0299-inch thick unless otherwise specified.
  2. Tube: ASTM A269, Alloy Type 302, 304, or 304L.
- C. Stainless Steel Tubing: ASTM A269, Grade 304 or 304L, seamless or welded.
- D. Stainless Steel Pipe: ASTM A312; Grade TP 304 or TP 304L.
- E. Steel Sheet: ASTM A653, zinc-coated (galvanized) coating designation G90.
- F. Glass:
  1. ASTM C1036, Type 1, Class 1, Quality q2, for mirrors, and for mirror

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doors in medicine cabinets.

2. ASTM C1036, Type 1 Class 1 Quality q3, for shelves in medicine cabinets.
3. ASTM C1048, Kind FT, Condition A, Type 1, Class 1 (use in Mental Health and Behavior Nursing Unit Psychiatric Patient Areas and Security Examination Rooms where mirrors and glass are specified).

**2.2 FASTENERS**

- A. Exposed Fasteners: Stainless steel or chromium plated brass, finish to match adjacent surface.
- B. Concealed Fasteners: Steel, hot-dip galvanized (except in high moisture areas such as showers or bath tubs use stainless steel).
- C. Toggle Bolts: For use in hollow masonry or frame construction.
- D. Hex bolts: For through bolting on thin panels.
- E. Expansion Shields: Lead or plastic as recommended by accessory manufacturer for component and substrate for use in solid masonry or concrete.
- F. Screws:
  1. ASME B18.6.4.
  2. Fed Spec. FF-S-107, Stainless steel Type A.

**2.3 FINISH**

- A. In accordance with NAAMM AMP 500 series.
- B. Anodized Aluminum:
  1. AA-C22A41 Chemically etched medium matte, with clear anodic coating, Class I Architectural, 0.7-mil thick.
  2. AA-C22A44 Chemically etched medium matte with electrolytically deposited metallic compound, integrally colored coating Class I Architectural, 0.7-mil thick finish. Dyes will not be accepted.
- C. AA-M32 Mechanical finish, medium satin.
  1. Chromium Plating: ASTM B456, satin or bright as specified, Service Condition No. SC2.
  2. Stainless Steel: NAAMM AMP 503, finish number 4.

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3. Ferrous Metal:

- a. Shop Prime: Clean, pretreat and apply one coat of primer and bake.
- b. Finish: Over primer apply two coats of alkyd or phenolic resin enamel, and bake.

4. Nylon Coated Steel: Nylon coating powder formulated for a fluidized bonding process to steel to provide a hard smooth, medium gloss finish, not less than 0.3 mm (0.012-inch) thick, rated as self-extinguishing when tested in accordance with ASTM D635.

**2.4 FABRICATION - GENERAL**

- A. Welding, AWS D10.4.
- B. Grind dress, and finish welded joints to match finish of adjacent surface.
- C. Form exposed surfaces from one sheet of stock, free of joints.
- D. Provide steel anchors and components required for secure installation.
- E. Form flat surfaces without distortion. Keep exposed surfaces free from scratches and dents. Reinforce doors to prevent warp or twist.
- F. Isolate aluminum from dissimilar metals and from contact with building materials as required to prevent electrolysis and corrosion.
- G. Hot-dip galvanized steel, except stainless steel, anchors and fastening devices.
- H. Shop-assemble accessories and package with all components, anchors, fittings, fasteners and keys.
- I. Key items alike.
- J. Provide templates and rough-in measurements as required.
- K. Round and deburr edges of sheets to remove sharp edges.

**2.5 GRAB BARS**

- A. Fed. Spec WW-P-541/8B, Type IV, bars, surface mounted, Class 2, grab bars and ASTM F446.

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- B. Fabricate of either stainless steel or nylon coated steel, except use only one type throughout the project:
  - 1. Stainless steel: Grab bars, flanges, mounting plates, supports, screws, bolts, and exposed nuts and washers.
- C. Concealed mount, except grab bars mounted at floor, swing up and on metal toilet partitions.
- D. Bars:
  - 1. Fabricate from 38 mm (1-1/2 inch) outside diameter tubing.
    - a. Stainless steel, minimum 1.2 mm (0.0478 inch) thick.
  - 2. Fabricate in one continuous piece with ends turned toward walls, except swing up and where grab bars are shown continuous around three sides of showers, bars may be fabricated in two sections, with concealed slip joint between.
  - 3. Continuous weld intermediate support to the grab bar.
  - 4. Swing up bars manually operated. Designed to prevent bar from falling when in raised position.
- E. Flange for Concealed Mounting:
  - 1. Minimum of 2.65 mm (0.1046 inch) thick, approximately 75 mm (3 inch) diameter by 13 mm (1/2 inch) deep, with provisions for not less than three set screws for securing flange to back plate.
  - 2. Insert grab bar through center of the flange and continuously weld perimeter of grab bar flush to back side of flange.
- F. In lieu of providing flange for concealed mounting, and back plate as specified, grab rail may be secured by being welded to a back plate and be covered with flange.
- G. Back Plates:
  - 1. Minimum 2.65 mm (0.1046 inch) thick metal.
  - 2. Fabricate in one piece, approximately 6 mm (1/4 inch) deep, with diameter sized to fit flange. Provide slotted holes to accommodate anchor bolts.
  - 3. Furnish spreaders, through bolt fasteners, and cap nuts, where grab bars are mounted on partitions.

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**2.6 CLOTHES HOOKS-ROBE OR COAT**

- A. Fabricate hook units either of chromium plated brass with a satin finish, or stainless steel, using 6 mm (1/4 inch) minimum thick stock, with edges and corners rounded smooth to the thickness of the metal, or 3 mm (1/8 inch) minimum radius.
- B. Fabricate each unit as a double hook on a single shaft, integral with or permanently fastened to the wall flange, provided with concealed fastenings.

**2.7 METAL FRAMED MIRRORS**

- A. Fed. Spec. A-A-3002 metal frame; stainless steel, type 302 or 304.
- B. Mirror Glass:
  - 1. Minimum 6 mm (1/4 inch) thick.
  - 2. Set mirror in a protective vinyl glazing tape.
  - 3. Use tempered glass for mirrors in Mental Health and Behavioral Nursing units.
- C. Frames:
  - 1. Channel or angle shaped section with face of frame not less than 9 mm (3/8 inch) wide. Fabricate with square corners.
  - 2. Use either 0.9 mm (0.0359 inch) thick stainless steel, chrome finished steel, or extruded aluminum, with clear anodized finish 0.4 mils thick.
  - 3. Filler:
    - a. Where mirrors are mounted on walls having ceramic tile wainscots not flush with wall above, provide fillers at void between back of mirror and wall surface.
    - b. Fabricate fillers from same material and finish as the mirror frame, contoured to conceal the void behind the mirror at sides and top.
  - 4. Attached Shelf for Mirrors:
    - a. Fabricate shelf of the same material and finish as the mirror frame.

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- b. Make shelf approximately 125 mm (five inches) in depth, and extend full width of the mirror.
- c. Close the ends and the front edge of the shelf to the same thickness as the mirror frame width.
- d. Form shelf for aluminum framed mirror as an integral part of the bottom frame member. Form stainless steel shelf with concealed brackets to attach to mirror frame.

**D. Back Plate:**

- 1. Fabricate backplate for concealed wall hanging of either zinc-coated, or cadmium plated 0.9 mm (0.036 inch) thick sheet steel, die cut to fit face of mirror frame, and furnish with theft resistant concealed wall fastenings.
- 2. Use set screw type theft resistant concealed fastening system for mounting mirrors.

**E. Mounting Bracket:**

- 1. Designed to support mirror tight to wall.
- 2. Designed to retain mirror with concealed set screw fastenings.

**2.8 MOP RACKS**

- A. Minimum 1.0M (40 inches) long with five holders.

**B. Clamps:**

- 1. Minimum of 1.3 mm (0.050-inch) thick stainless steel bracket retaining channel with a hard rubber serrated cam; pivot mounted to channel.
- 2. Clamps to hold handles from 13 mm (1/2-inch) minimum to 32 mm (1-1/4 inch) maximum diameter.

**C. Support:**

- 1. Minimum of 1 mm (0.0375 inch) thick stainless steel hat shape channel to hold clamps away from wall as shown.
- 2. Drill wall flange for 3 mm (1/8 inch) fasteners above and below clamp locations.

- D. Secure clamps to support with oval head machine screws or rivets into continuous reinforcing back of clamps.

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E. Finish on stainless Steel: AMP 503-No. 4.

**2.9 STAINLESS STEEL SHELVES, TYPES 45, AND 45C.**

- A. Fabricate shelves and brackets to design shown of 1.2 mm (0.0478-inch) thick stainless steel.
- B. Round and finish smooth projecting corners of shelves and edge corners of brackets. Drill brackets for 6 mm (1/4-inch) anchor bolts.
- C. Screw or weld brackets to shelves.

**PART 3 - EXECUTION**

**3.1 PREPARATION**

- A. Before starting work notify Resident Engineer in writing of any conflicts detrimental to installation or operation of units.
- B. Verify with the Resident Engineer the exact location of accessories.

**3.2 INSTALLATION**

- A. Set work accurately, in alignment and where shown. Items shall be plumb, level, free of rack and twist, and set parallel or perpendicular as required to line and plane of surface.
- B. Toggle bolt to steel anchorage plates in frame partitions or hollow masonry. Expansion bolt to concrete or solid masonry.
- C. Install accessories in accordance with the manufacturer's printed instructions and ASTM F446.
- D. Install accessories plumb and level and securely anchor to substrate.
- E. Install accessories in a manner that will permit the accessory to function as designed and allow for servicing as required without hampering or hindering the performance of other devices.
- F. Position and install dispensers, and other devices in countertops, clear of drawers, permitting ample clearance below countertop between devices, and ready access for maintenance as needed.
- G. Align mirrors, dispensers and other accessories even and level, when installed in battery.



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- H. Install accessories to prevent striking by other moving, items or interference with accessibility.

**3.3 SCHEDULE OF ACCESSORIES**

**3.4 CLEANING**

- A. After installation, clean as recommended by the manufacturer and protect from damage until completion of the project.

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SECTION 10 44 13

FIRE EXTINGUISHER CABINETS

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This section covers recessed fire extinguisher cabinets.

1.2 RELATED WORK

- A. Acrylic glazing: Section 08 80 00, GLAZING.
- B. Field Painting: Section 09 91 00, PAINTING.

1.3 SUBMITTALS

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Manufacturer's Literature and Data: Fire extinguisher cabinet including installation instruction and rough opening required.

1.4 APPLICATION PUBLICATIONS

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.
- B. American Society of Testing and Materials (ASTM):
  - 1. D4802-10 Poly (Methyl Methacrylate) Acrylic Plastic Sheet

PART 2 - PRODUCTS

2.1 FIRE EXTINGUISHER CABINET

- A. Recessed type with flat trim of size and design shown.

2.2 FABRICATION

- A. Form body of cabinet from 0.9 mm (0.0359 inch) thick sheet steel.
- B. Fabricate door and trim from 1.2 mm (0.0478 inch) thick sheet steel with all face joints fully welded and ground smooth.
  - 1. Glaze doors with 6 mm (1/4 inch) thick ASTM D4802, clear acrylic sheet, Category B-1, Finish 1.

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2. Design doors to open 180 degrees.
3. Provide continuous hinge, pull handle, and adjustable roller catch.

**2.3 FINISH**

- A. Finish interior of cabinet body with baked-on semigloss white enamel.
- B. Finish door, frame with manufacturer's standard baked-on prime coat suitable for field painting.

**PART 3 - EXECUTION**

- A. Install fire extinguisher cabinets in prepared openings and secure in accordance with manufacturer's instructions.
- B. Install cabinet so that bottom of cabinet is 975 mm (39 inches) above finished floor.

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**SECTION 11 70 00  
HEALTHCARE EQUIPMENT**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

- A. Medical grade freezer, undercounter.
- B. Medical grade refrigerator, undercounter.
- C. Refrigerator, undercounter.
- D. Refrigerator, 14 cubic feet.

**1.4 SUBMITTALS**

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Manufacturer's Literature and Data
- C. Operating Test Data.
- D. Maintenance and operating manuals in accordance with Section 01 00 00, GENERAL REQUIREMENTS.

**PART 2 - PRODUCTS**

**2.1 MEDICAL GRADE FREEZER, UNDERCOUNTER**

- A. Description: 20-inch wide all-freezer designed for built-in installation under lower counters. Manual defrost with four removable interior drawers with clear fronts. Top-mounted keyed lock and traceable thermometer that displays current and high/low temperatures. Includes hospital grade cord.
- B. Height: 32 inches.
- C. Capacity: 4.2 cubic feet.
- D. Fully finished white cabinet.
- E. Low Temperature: Minus 20 degrees.
- F. Adjustable thermostat.

**2.2 MEDICAL GRADE REFRIGERATOR, UNDERCOUNTER**

- A. Description: 20-inch wide all-refrigerator designed for built-in installation under lower counters. Automatic defrost with internal fan with gel packs for stabilized cooling. Includes adjustable shelves, interior light, hospital grade cord with green dot plug, and factory-installed top-mounted lock. Commercially listed to NSF-7 standards.
- B. Traceable thermometer providing external readout of current and high/low temperature.
- C. Flat door liner.
- D. Interior light with rocker switch.

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- E. 100 percent CFC-free.
- F. Fully finished white cabinet.
- G. Capacity: 4.1 cubic feet.

**2.3 REFRIGERATOR, UNDERCOUNTER**

- A. Description: 32 inches high by 20 inches wide all-refrigerator with full automatic defrost, designed for ADA compliant settings and commercially listed for foodservice use conforming to NSF-7 standards. Includes 3 adjustable wire shelves, one crisper drawer, flat door liners and interior lighting on rocker switch.
- B. Factory-installed lock.
- C. Hospital grade cord with green dot plug.
- D. Fully finished white cabinet.

**2.4 REFRIGERATOR, 14 CUBIC FEET**

- A. Basic Features:
  - 1. Black cabinet finish with stainless steel door handles, door stops/door closers, and hinge covers.
  - 2. Front and rear adjustable roller.
  - 3. Energy saving technology.
  - 4. Top right rear water filter.
  - 5. Manufacturer's quiet sound package.
  - 6. Total Capacity: 22.6 cubic feet.
    - a. Refrigerator Capacity: 14.05 cubic feet.
    - b. Freezer Capacity: 8.58 cubic feet.
- B. Dispenser: Tall, single paddle with 7 dispenser buttons including crushed ice, cube ice, and chilled water. Includes display on/of, control lock/light, temperature/door ajar/power failure alters, water filter change indicator light, and air filter change indicator.
- C. Refrigerator Features:
  - 1. Manufacturer's standard interior lighting.
  - 2. Water filter and air filter.
  - 3. 1 fixed shelf and 2 sliding shelves.
  - 4. 1 drawer.
  - 5. 1 clear can rack.
  - 6. 1 clear upper crisper and 1 clear lower crisper.
  - 7. 2 humidity controls.
  - 8. 1 clear dairy compartment.
  - 9. 2 clear 2-liter adjustable door bins and 1 clear one-gallon fixed door bin.

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10. 1 clear bottle retainer.

11. 1 clear condiment bin.

**D. Freezer Features:**

1. 3 clear door bins and 1 tilt-out wire door bin.

2. 2 wire fixed shelves and 2 full freezer baskets.

3. Ice cream shelf.

4. Interior light.

5. Energy Star certified.

**PART 3 - EXECUTION**

**3.1 INSTALLATION**

A. Install refrigeration equipment as described in the respective manufacturer's instructions. Make panel joints tight and seal all panel penetrations to prevent condensation or frosting.

**3.2 REFRIGERATOR START-UP, AND PERFORMANCE TESTS AND INSTRUCTIONS**

A. Start-up Temperature Reduction: On start-up, reset the room thermostats daily for a maximum temperature drop of 8 degrees, on C scale (15 degrees on F scale per day down to 2 degrees C (36 degrees F), and a maximum of 6 degrees on C scale, (10 degrees on F scale) per day between 2 degrees C (36 degrees F) and final operating temperature.

B. Perform test in accordance with Section 01 00 00, GENERAL REQUIREMENTS. Operate each system and record conditions hourly for eight hours.

Submit the following information:

1. Station, Building and System Identification, Contractor, Date and Time.

2. Compressor nameplate data: Make, model, horsepower, RPM, refrigerant and charge in pounds.

3. Compressor operation: Approximate percentage running time, pressure gage readings, actual amps (starting and running), condenser water temperature in and out, or condenser entering air temperature.

4. Room temperatures.

5. Defrost and drain functions of unit coolers. Demonstrate alarm functions.

C. By arrangement with the Resident Engineer, 24 hours in advance, use the start-up and test period for required operation and maintenance instructions to VA personnel in accordance with Section 01 00 00, GENERAL REQUIREMENTS.

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SECTION 12 24 00  
WINDOW SHADES

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

Between-the-glass blinds are specified in this section, furnished complete, including brackets, fittings and hardware.

**1.3 QUALITY CONTROL**

Manufacturer's Qualification: Between-the-glass blind manufacturer shall provide evidence that the manufacture of blinds are a major product, and that the blinds have performed satisfactorily on similar installations.

**1.4 SUBMITTALS**

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Samples:
  - 1. Between-the-glass blind slats, 300 mm (12 inches) long, including chain and supporting channels, showing color and finish.
- C. Manufacturer's literature and data; showing details of construction and hardware for:  
Between-the-glass blinds

**PART 2 - PRODUCTS**

**2.1 MANUFACTURERS**

- A. Window Accessory Company, Incorporated.
- B. Alpha Door and Rail.
- C. Allied Window Inc.

**2.2 BETWEEN-THE-GLASS BLINDS**

- A. Headrail: 0.625-inch wide by 0.650-inch high by 0.050-inch thick 6063-T5 extruded aluminum with baked-on polyester powder coat finishing conforming to AAMA specification #603.8-1985 voluntary specification for organic coatings on architectural extrusions.
- B. Bottom Rail: 0.625-inch wide by 0.375-inch high by 0.050-inch thick 6063-T5 extruded aluminum with a baked-on polyester powder coat finish conforming to AAMA specification #603.8-1985 voluntary specification for organic coatings on architectural extrusions.
- C. Slat: 0.006-inch thick virgin aluminum alloy. Slats to be finished with organic primer and baked-on enamel finish coat to withstand 500 hours of exposure to 100 percent relative humidity, 300 hours at 20 percent salt spray solution at 95 deg. F, and 250 hours of accelerated weathering without blistering, fading, or corroding. Color: White.

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- D. Ladder Cord: Braided synthetic yarn designed to have maximum flexibility and tensile strength. Ladder cord locations shall not exceed 5-inches from end of slat or 16 inches apart.
- E. Ladder/Tape Drum Support: Plastic material to prevent corrosion. All lift cords guided by Ladder/Tape Drum Support over plated steel cord pin assembly to minimize wear on lift cords and facilitate operation of raising and lowering the blind.
- F. Lift Cord: Braided synthetic yarn with minimum tensile strength of 130 lbs. Lift cords securely fastened to bottom rail at distance not to exceed 32 inches on blinds larger than 15 square feet and 48 inches on blinds smaller than 15 square feet. Lift cord includes zinc plated steel lift ring at end to secure blind in "up" position during shipment of windows. Ring diameter shall not exceed 0.682-inch. Lift cord shall run through 0.225-inch inside diameter plated steel eyelet in head rail end cap to minimize wear on the cord and head rail end cap.
- G. Mounting Hardware: 33 percent glass filled nylon mounting clip designed to match profile of head rail allowing head rail to be "snapped" into place, and be removable.
- H. Tilt Control Knob: Maximum diameter 0.500-inch with serrations around perimeter to facilitate operation. Tilt knob designed to be fastened to window using #10 pan head or #8 truss head fasteners.
- I. Flexible Cable Operators: Brass or bronze coated high tensile steel wire wound in four layers to outside diameter of 0.130-inch. Brass fittings on ends of flexible cables shall not be less than 0.3125-inch in diameter. All fittings shall be crimped in six locations onto flexible cables to insure that fittings will not work loose from end of cable under normal use conditions. Exposed cable shall be sheathed in 0.015-inch thick weatherstripping grade vinyl. Cables attached to D-shaped steel control rod using #4-40 stainless steel set screws. Length of finished cables shall be 6 inches.
- J. Slip Mechanism: Blind designed with slip mechanism which will minimize damage due to over tilting blind. When blind reaches its closed position and tilt knob is turned, there will be no damage to the blind or its operational hardware.
  - 1. Slip mechanism accomplished by utilizing 33 percent glass filled nylon tape drum assembly to minimize discoloration of ladder cord during long term operation.

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- K. Tilt Rod Assembly: Spring-loaded tilt rod assembly within head rail designed to allow approximately 1-inch lateral movement of tilt rod away from control end of head rail.
- I. Tape Spacers: Clear plastic tape spacers used on top slat at all ladder locations to insure proper tilting and alignment of blind. Clear plastic injection molded tape spacers used to eliminate scratches on head rail and second slat.

**PART 3 - EXECUTION**

**3.1 INSTALLATION**

- A. Between-The-Glass Blinds: Support blinds in level position by brackets and intermediate supports recommended by manufacturer for applications shown on Drawings that will permit easy removal and replacement of units without damage to blind, or adjacent surfaces.
  - 1. Install blinds between panes of glass as indicated on Drawings and in accordance with manufacturer's recommendations and instructions.
  - 2. Protect blinds against defacements, warpage of slats, or bending of rails. Warped or damaged slats, or bent rails shall be removed from the site immediately and replaced. Scratching or other defacements shall be repaired at the Contractor's expense and as approved by the Resident Engineer.

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SECTION 12 36 00

COUNTERTOPS

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This section specifies casework countertops with integral accessories.
- B. Integral accessories include:
  - 1. Sinks.

1.2 RELATED WORK

- A. Color and patterns of plastic laminate: Finish Legend.
- B. DIVISION 22, PLUMBING.
- C. DIVISION 26, ELECTRICAL.
- D. Equipment Reference Manual for SECTION 12 36 00, COUNTERTOPS.

1.3 SUBMITTALS

- A. Submit in accordance with SECTION 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Shop Drawings:
  - 1. Show dimensions of section and method of assembly.
  - 2. Show details of construction at 1/2 scale.
- C. Samples:
  - 1. 150 mm (6 inch) square samples each top.
  - 2. Front edge, back splash, end splash and core with surface material and booking.

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**1.4 APPLICABLE PUBLICATIONS**

A. Publications listed below form a part of this specification to the extent referenced. Publications are referenced in the text by the basic designation only.

B. American Society for Testing and Materials (ASTM):

1. D638-08                      Tensile Properties of Plastics
2. D785-08                      Rockwell Hardness of Plastics and Electrical  
                                 Insulating Materials

**PART 2 - PRODUCTS**

**2.1 MATERIALS**

Solid Polymer Material:

1. Composition of acrylic polymer and alumina trihydrate (ATH) or similar solid surfacing composition.
2. Performance properties required:

Property	Result	Test
Elongation	0.4% min.	ASTM D638
Hardness	85 Rockwell M	ASTM D785
Impact resistance	No fracture	NEMA LD-3 900 mm (36") drop 1 kg (2 lb.) ball
Boiling water surface resistance	No visible change	NEMA LD3
High temperature	Slight surface dulling	NEMA LD3

3. Cast into sheet form and bowl form.
4. Color throughout with subtle veining through thickness.
5. Joint adhesive and sealer: Manufacturers silicone adhesive and sealant for joining methyl methacrylic polymer sheet.
6. Bio-based products will be preferred.

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**B. Quartz Surface**

1. Material: Quartz and resin with bonding agent forming slab product.
2. Minimum Physical Properties:
  - a. Flexural Strength: 7,158 psi (49.35 Mpa).
  - b. Compressive Strength: 27,234 psi (187.75 Mpa).
  - c. Moisture Absorption: 0.13 percent.

**2.2 COUNTERTOPS**

- A. Fabricate in largest sections practicable.
- B. Fabricate with joints flush on top surface.
- C. Fabricate countertops to overhang front of cabinets and end of assemblies 25 mm (one inch) except where against walls or cabinets.
- D. Provide 1 mm (0.039 inch) thick metal plate connectors or fastening devices (except epoxy resin tops).
- E. Join edges in a chemical resistant waterproof cement or epoxy cement, except weld metal tops.
- F. Fabricate with end splashes where against walls or cabinets.
- G. Splash Backs and End Splashes:
  1. Not less than 19 mm (3/4 inch) thick.
  2. Height 100 mm (4 inches) unless noted otherwise.
- H. Drill or cutout for sinks, and penetrations.
  1. Accurately cut for size of penetration.
- I. Solid Polymer Tops:
  1. Solid polymer with drip groove cut on underside of overhanging edge.
  2. Finish thickness of top minimum 25 mm (1 inch).
  3. Joints: Manufacturer's standards.

**PART 3 - EXECUTION**

**3.1 INSTALLATION**

- A. Before installing countertops verify that wall surfaces have been

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finished as specified and that mechanical and electrical service locations are as required.

- B. Secure countertops to supporting rails of cabinets with metal fastening devices, or screws through pierced slots in rails.
  - 1. Where type, size or spacing of fastenings is not shown or specified, submit shop drawings showing proposed fastenings and method of installation.
  - 2. Use round head bolts or screws.
- C. Faucets, Fixtures, and Outlets:
  - 1. Seal opening between fixture and top.
  - 2. Secure to top with manufacturers standard fittings.

**3.2 PROTECTION AND CLEANING**

- A. Tightly cover and protect against dirt, water, and chemical or mechanical injury.
- B. Clean at completion of work.

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**SECTION 13 05 41  
SEISMIC RESTRAINT REQUIREMENTS FOR NON-STRUCTURAL COMPONENTS**

**PART 1 - GENERAL**

**1.1 DESCRIPTION:**

- A. Provide seismic restraint in accordance with the requirements of this section in order to maintain the integrity of nonstructural components of the building so that they remain safe and functional in case of seismic event.
- B. Definitions: Non-structural building components are components or systems that are not part of the building's structural system whether inside or outside, above or below grade. Non-structural components of buildings include:
  - 1. Architectural Elements: Nonbearing partitions; suspended ceilings; cabinets; bookshelves; medical equipment; and storage racks.
  - 2. Electrical Elements: Power and lighting systems; fire protection and alarm systems; special life support systems; and telephone and communication systems.
  - 3. Mechanical Elements: Heating, ventilating, and air-conditioning systems; medical gas systems; plumbing systems; sprinkler systems; pneumatic systems.

**1.2 COMPONENT DESIGN PARAMETERS**

- A. Refer to Drawing 1-SJ001 Anticipated Seismic Design Parameters and Interstory Drifts.

**1.3 RELATED WORK:**

- A. Section No. 09 22 16 Non-Structural Metal Framing
- B. Section No. 09 51 00 Acoustical Ceilings
- C. Section No. 21 05 11 Common Work Results for Fire Suppression
- D. Section No. 22 05 11 Common Work Results for Plumbing
- E. Section No. 23 05 11 Common Work Results for HVAC
- F. Section No. 23 05 41 Noise and Vibration Control for HVAC Piping and Equipment.
- H. Section No. 23 21 13 Hydronic Piping
- I. Section No. 23 31 00 HVAC Dusts and Casings
- J. Section No. 23 34 00 HVAC Fans
- K. Section No. 23 36 00 Air Terminal Units
- L. Section No. 23 37 00 Air Outlets and Inlets
- M. Section No. 23 73 00 Indoor Central Station Air Handling Units
- N. Section No. 23 82 00 Convection Heating and Cooling Units

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- O. Section No. 26 24 16 Panelboards
- P. Section No. 26 29 11 Motor Controllers
- Q. Section No. 26 29 21 Enclosed Switches and Circuit Breakers
- R. Section No. 26 51 00 Interior lighting
- S. Section No. 27 05 33 Raceways and Boxes for Communications Systems
- T. Section No. 27 11 00 Communications Equipment Room Fittings
- U. Section No. 28 05 28.33 Conduits and Backboxes for Electronic Safety and Security

**1.4 QUALITY CONTROL:**

**A. Shop-Drawing Preparation:**

- 1. Have seismic-force-restraint shop drawings and calculations prepared by a professional structural engineer experienced in the area of seismic force restraints. The professional structural engineer shall be registered in the state where the project is located.
- 2. Submit design tables and information used for the design-force levels, stamped and signed by a professional structural engineer registered in the State where project is located.

**B. Coordination:**

- 1. Do not install seismic restraints until seismic restraint submittals are approved by the Resident Engineer.
- 2. Coordinate and install trapezes or other multi-pipe hanger systems prior to pipe installation.

**C. Seismic Certification:**

In structures assigned to IBC Seismic Design Category C, D, E, or F, permanent equipments and components are to have Special Seismic Certification in accordance with requirements of section 13.2.2 of ASCE 7 except for equipment that are considered rugged as listed in section 2.2 OSHPD code application notice CAN No. 2-1708A.5, and shall comply with section 13.2.6 of ASCE 7.

**1.5 SUBMITTALS:**

**A. Submit a coordinated set of equipment anchorage drawings prior to installation including:**

- 1. Description, layout, and location of items to be anchored or braced with anchorage or brace points noted and dimensioned.
- 2. Details of anchorage or bracing at large scale with all members, parts brackets shown, together with all connections, bolts, welds etc. clearly identified and specified.
- 3. Numerical value of design seismic brace loads.

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4. For expansion bolts, include design load and capacity if different from those specified.
- B. Submit prior to installation, a coordinated set of bracing drawings for seismic protection of piping, with data identifying the various support-to-structure connections and seismic bracing structural connections, include:
  1. Single-line piping diagrams on a floor-by-floor basis. Show all suspended piping for a given floor on the same plain.
  2. Type of pipe (Copper, steel, cast iron, insulated, non-insulated, etc.).
  3. Pipe contents.
  4. Structural framing.
  5. Location of all gravity load pipe supports and spacing requirements.
  6. Numerical value of gravity load reactions.
  7. Location of all seismic bracing.
  8. Numerical value of applied seismic brace loads.
  9. Type of connection (Vertical support, vertical support with seismic brace etc.).
  10. Seismic brace reaction type (tension or compression): Details illustrating all support and bracing components, methods of connections, and specific anchors to be used.
- C. Submit prior to installation, bracing drawings for seismic protection of suspended ductwork and suspended electrical and communication cables, include:
  1. Details illustrating all support and bracing components, methods of connection, and specific anchors to be used.
  2. Numerical value of applied gravity and seismic loads and seismic loads acting on support and bracing components.
  3. Maximum spacing of hangers and bracing.
  4. Seal of registered structural engineer responsible for design.
- D. Submit design calculations prepared and sealed by the registered structural engineer specified above in paragraph 1.3A.
- E. Submit for concrete anchors, the appropriate ICBC evaluation reports, OSHPD pre-approvals, or lab test reports verifying compliance with OSHPD Interpretation of Regulations 28-6.

**1.6 APPLICABLE PUBLICATIONS:**

- A. The Publications listed below (including amendments, addenda revisions, supplements and errata) form a part of this specification to the extent referenced. The publications are referenced in text by basic designation only.

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- B. American Concrete Institute (ACI):
  - 355.2-07 .....Qualification for Post-Installed Mechanical Anchors in Concrete and Commentary
- C. American Institute of Steel Construction (AISC):
  - Load and Resistance Factor Design, Volume 1, Second Edition
- D. American Society for Testing and Materials (ASTM):
  - A36/A36M-08 .....Standard Specification for Carbon Structural Steel
  - A53/A53M-10 .....Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless
  - A307-10 .....Standard Specification for Carbon Steel Bolts and Studs; 60,000 PSI Tensile Strength.
  - A325-10 .....Standard Specification for Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength
  - A325M-09 .....Standard Specification for High-Strength Bolts for Structural Steel Joints [Metric]
  - A490-10 .....Standard Specification for Heat-Treated Steel Structural Bolts, 150 ksi Minimum Tensile Strength
  - A490M-10 .....Standard Specification for High-Strength Steel Bolts, Classes 10.9 and 10.9.3, for Structural Steel Joints [Metric]
  - A500/A500M-10 .....Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes
  - A501-07 .....Specification for Hot-Formed Welded and Seamless Carbon Steel Structural Tubing
  - A615/A615M-09 .....Standard Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement
  - A992/A992M-06 .....Standard Specification for Steel for Structural Shapes for Use in Building Framing
  - A996/A996M-09 .....Standard Specification for Rail-Steel and Axel-Steel Deformed Bars for Concrete Reinforcement
  - E488-96(R2003) .....Standard Test Method for Strength of Anchors in Concrete and Masonry Element
- E. American Society of Civil Engineers (ASCE 7) Latest Edition.
- F. International Building Code (IBC) Latest Edition
- G. VA Seismic Design Requirements, H-18-8, February 2011

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- H. National Uniform Seismic Installation Guidelines (NUSIG)
- I. Sheet Metal and Air Conditioning Contractors National Association (SMACNA): Seismic Restraint Manual - Guidelines for Mechanical Systems, 1998 Edition and Addendum

**1.7 REGULATORY REQUIREMENT:**

- A. IBC 2009.
- B. Exceptions: The seismic restraint of the following items may be omitted:
  - 1. Equipment weighing less than 400 pounds, which is supported directly on the floor or roof.
  - 2. Equipment weighing less than 20 pounds, which is suspended from the roof or floor or hung from a wall.
  - 3. Gas and medical piping less than 1" inch inside diameter.
  - 4. Piping in boiler plants and equipment rooms less than 1 ¼ inches inside diameter.
  - 5. All other piping less than 2 ½ inches inside diameter, except for automatic fire suppression systems.
  - 6. All piping suspended by individual hangers, 12 inches or less in length from the top of pipe to the bottom of the support for the hanger.
  - 7. All electrical conduits, less than 2 ½ inches inside diameter.
  - 8. All rectangular air handling ducts less than six square feet in cross sectional area.
  - 9. All round air handling ducts less than 28 inches in diameter.
  - 10. All ducts suspended by hangers 12 inches or less in length from the top of the duct to the bottom of support for the hanger.

**PART 2 - PRODUCTS**

**2.1 STEEL:**

- A. Structural Steel: ASTM A36 // A36M // A992 //.
- B. Structural Tubing: ASTM A500, Grade B.
- C. Structural Tubing: ASTM A501.
- D. Steel Pipe: ASTM A53/A53M, Grade B.
- E. Bolts & Nuts: ASTM // A307 // A325 // A325M // A490 // A490M //.

**2.2 CAST-IN-PLACE CONCRETE:**

- A. Concrete: 28 day strength, f'c = // 25 MPa (3,000 psi)
- B. Reinforcing Steel: ASTM A615/615M or ASTM A996/A996M deformed.

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**PART 3 - EXECUTION**

**3.1 CONSTRUCTION, GENERAL:**

- A. Provide equipment supports and anchoring devices to withstand the seismic design forces, so that when seismic design forces are applied, the equipment cannot displace, overturn, or become inoperable.
- B. Provide anchorages in conformance with recommendations of the equipment manufacturer and as shown on approved shop drawings and calculations.
- C. Construct seismic restraints and anchorage to allow for thermal expansion.
- D. Testing Before Final Inspection:
  - 1. Test 10-percent of anchors in masonry and concrete per ASTM E488, and ACI 355.2 to determine that they meet the required load capacity. If any anchor fails to meet the required load, test the next 20 consecutive anchors, which are required to have zero failure, before resuming the 10-percent testing frequency.
  - 2. Before scheduling Final Inspection, submit a report on this testing indicating the number and location of testing, and what anchor-loads were obtained.

**3.2 EQUIPMENT RESTRAINT AND BRACING:**

- A. Restrain all equipment not meeting the exceptions noted in Section 1.7B.

**3.3 MECHANICAL DUCTWORK AND PIPING; BOILER PLANT STACKS AND BREACHING;  
ELECTRICAL BUSWAYS, CONDUITS, AND CABLE TRAYS; AND TELECOMMUNICATION WIRES  
AND CABLE TRAYS**

- A. Support and brace mechanical ductwork and piping; electrical busways, conduits and cable trays; and telecommunication wires and cable trays including boiler plant stacks and breeching to resist directional forces (lateral, longitudinal and vertical).
- B. Brace duct and breeching branches with a minimum of 1 brace per branch.
- D. Provide supports and anchoring so that, upon application of seismic forces, piping remains fully connected as operable systems which will not displace sufficiently to damage adjacent or connecting equipment, or building members.
- E. Seismic Restraint of Piping:
  - 1. Design criteria:
    - a. Piping resiliently supported: Restrain to support // 120 //  
-percent of the weight of the systems and components and contents.
    - b. Piping not resiliently supported: Restrain to support // 60 //  
-percent of the weight of the system components and contents.

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2. Provide seismic restraints according to one of the following options:

- F. Piping Connections: Provide flexible connections where pipes connect to equipment. Make the connections capable of accommodating relative differential movements between the pipe and equipment under conditions of earthquake shaking.

**3.4 PARTITIONS**

- A. Anchor partitions to only structural element, such as a floor slab, and separate such partition by a physical gap from all other structural elements.
- B. Properly anchor masonry walls to the structure for restraint, so as to carry lateral loads imposed due to earthquake along with their own weight and other lateral forces.

**3.5 CEILINGS AND LIGHTING FIXTURES**

- A. At regular intervals, laterally brace suspended ceilings against lateral and vertical movements, and provide with a physical separation at the walls.
1. Design and install suspended ceilings in accordance with ASCE 7-05 Section 13.5.6 and ASTM E580.
- B. Independently support and laterally brace all lighting fixtures. Refer to applicable portion of lighting specification, Section 26 51 00, INTERIOR LIGHTING.

**3.6 STORAGE RACKS, CABINETS, AND BOOKCASES**

- A. Install storage racks to withstand earthquake forces and anchored to the floor or laterally braced from the top to the structural elements.
- B. Anchor medical supply cabinets to the floor or walls and equip them with properly engaged, lockable latches.
- C. Anchor filing cabinets that are more than 2 drawers high to the floor or walls, and equip all drawers with properly engaged, lockable latches.
- D. Anchor bookcases that are more than 30 inches high to the floor or walls, and equip any doors with properly engaged, lockable latches.

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SECTION 21 05 11  
COMMON WORK RESULTS FOR FIRE SUPPRESSION

PART 1 - GENERAL

1.1 DESCRIPTION

- A. The requirements of this Section apply to all sections of Division 21.
- B. Definitions:
  - 1. Exposed: Piping and equipment exposed to view in finished rooms.
  - 2. Option or optional: Contractor's choice of an alternate material or method.

1.2 RELATED WORK

- A. Section 01 00 00, GENERAL REQUIREMENTS.
- B. Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- C. Concrete and Grout: Section 03 30 00, CAST-IN-PLACE CONCRETE.
- D. Section 05 50 00, METAL FABRICATIONS.
- E. Section 07 84 00, FIRESTOPPING.
- F. Flashing for Wall and Roof Penetrations: Section 07 60 00, FLASHING AND SHEET METAL.
- G. Section 07 92 00, JOINT SEALANTS.
- H. Section 09 91 00, PAINTING.
- I. Section 13 05 41, SEISMIC RESTRAINT REQUIREMENTS FOR NON-STRUCTURAL COMPONENTS
- J. Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS

1.3 QUALITY ASSURANCE

- A. Products Criteria:
  - 1. Standard Products: Material and equipment shall be the standard products of a manufacturer regularly engaged in the manufacture of the products for at least 3 years. See other specification sections for any exceptions.
  - 2. Equipment Service: Products shall be supported by a service organization which maintains a complete inventory of repair parts and is located reasonably close to the site.
  - 3. Multiple Units: When two or more units of materials or equipment of the same type or class are required, these units shall be products of one manufacturer.
  - 4. Assembled Units: Manufacturers of equipment assemblies, which use components made by others, assume complete responsibility for the final assembled product.
  - 5. Nameplates: Nameplate bearing manufacturer's name or identifiable trademark shall be securely affixed in a conspicuous place on

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equipment, or name or trademark cast integrally with equipment, stamped or otherwise permanently marked on each item of equipment.

6. Asbestos products or equipment or materials containing asbestos shall not be used.

B. Manufacturer's Recommendations: Where installation procedures or any part thereof are required to be in accordance with the recommendations of the manufacturer of the material being installed, printed copies of these recommendations shall be furnished to the Resident Engineer prior to installation. Installation of the item will not be allowed to proceed until the recommendations are received. Failure to furnish these recommendations can be cause for rejection of the material.

C. Guaranty: In GENERAL CONDITIONS.

D. Extended Guarantee Period Services:

1. Qualifications: All service technicians assigned to perform work under this contract shall be qualified and factory trained by the Original Equipment Manufacturer (O.E.M.). Each technician shall have at least three years experience of working on comparable systems and shall be a full time employee of the contractor. The contractor shall furnish, for the Department of Veterans Affairs (VA) review and approval, resumes of all service technicians scheduled to service the equipment and systems. The resume shall include details of experience, training, and educational qualifications and performance evaluations.
2. Replacement Parts: The contractor shall be equipped with all replacement parts of all equipment and systems to be serviced and the manufacturer's standard service and repair procedures. All replacement parts shall be brand new and of current design. The replacement parts shall be O.E.M. items. Obsolete or refurbished parts are unacceptable. "Approved Equal" parts must have prior approval of the Contracting Officer. Contractor shall furnish evidence of guaranteed supply of parts for the life of the system.
3. Service Supplies: The services shall include, without any additional cost to the government, all replacement parts, special tools and equipment, and consumable materials, that is, lubrication oil, grease, and cleaning materials, as required. The requirement of UL listing, where applicable, shall not be voided by any replacement parts, components, software, or modifications provided by the contractor.
4. Licensing: The contractor shall be licensed to perform the contracted services. The contractor shall furnish details of all applicable

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- local and state licensing requirements to VA as a part of the qualification requirements. The licenses shall be current, valid through the term of the contract and in the name of the contractor.
5. Documentation Requirements: The contractor shall maintain a separate log for each item of equipment and each system covered under the extended guarantee period service contract with the VA Medical Center (VAMC) Engineering Service. The log shall list dates and times of all scheduled and emergency calls. Each emergency call shall be described with details of the nature and causes of emergency, steps taken to rectify the situations, and specific recommendations to avoid such conditions in the future.
  6. Reports: The contractor shall provide a quarterly report for the first year and twice a year for the remainder of the guarantee period for all equipment and systems serviced under the extended guarantee period contract. The report shall clearly and concisely describe the services rendered, parts replaced, and repairs performed. The report shall prescribe anticipated future needs of the equipment and systems for preventive and predictive maintenance.
  7. Quality Program: The contractor shall provide a description of the quality management and control program. The description shall include a tangible proof the existence of such program, names of at least three customers who have participated in the program, and specific information showing the applicability of program to the project.
  8. Training: During each scheduled service visit, the contractor shall actively involve the VAMC maintenance personnel in performing scheduled service and associated activities. The practical training during the scheduled service visits shall include parting oral and written instructions, for each specific task of the servicing contract, to the VAMC maintenance personnel who shall operate the hardware and software in accordance with the intent of the design and under direct supervision of the service contractor's qualified service technician. At the end of the first year of the service contract, the contractor shall obtain a certificate from the VAMC Engineering Service confirming completion of training to the authorized VA representatives.
  9. Classroom Training: Provide list and costs of available classroom training courses offered by contractor or O.E.M.
- E. Supports for sprinkler piping shall be in conformance with NFPA 13.
- F. Supports for standpipe shall be in conformance with NFPA 14.

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**1.4 SUBMITTALS**

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Manufacturer's Literature and Data: Submit under the pertinent section rather than under this section.
  - 1. Equipment and materials identification.
  - 2. Fire-stopping materials.
  - 3. Hangers, inserts, supports and bracing. Provide load calculations for variable spring and constant support hangers.
  - 4. Wall, floor, and ceiling plates.
- C. Coordination Drawings: Provide detailed layout drawings of all piping systems. Provide details of the following:
  - 1. Mechanical equipment rooms.
  - 2. Hangers, inserts, supports, and bracing.
  - 3. Pipe sleeves.
  - 4. Equipment penetrations of floors, walls, ceilings, or roofs.
- D. Maintenance Data and Operating Instructions:
  - 1. Maintenance and operating manuals in accordance with Section 01 00 00, GENERAL REQUIREMENTS, Article, INSTRUCTIONS, for systems and equipment.
  - 2. Provide a listing of recommended replacement parts for keeping in stock supply, including sources of supply, for equipment. Include in the listing belts for equipment.

**1.5 APPLICABLE PUBLICATIONS**

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.
- B. American Society for Testing and Materials (ASTM):
  - A36/A36M-2001 .....Carbon Structural Steel
  - A575-96 .....Steel Bars, Carbon, Merchant Quality, M-Grades R (2002)
  - E84-2003 .....Standard Test Method for Burning Characteristics of Building Materials
  - E119-2000 .....Standard Test Method for Fire Tests of Building Construction and Materials
- C. National Fire Protection Association (NFPA):
  - 90A-96 .....Installation of Air Conditioning and Ventilating Systems
  - 101-97 .....Life Safety Code

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**PART 2 - PRODUCTS**

**2.1 LIFTING ATTACHMENTS**

Provide equipment with suitable lifting attachments to enable equipment to be lifted in its normal position. Lifting attachments shall withstand any handling conditions that might be encountered, without bending or distortion of shape, such as rapid lowering and braking of load.

**2.2 EQUIPMENT AND MATERIALS IDENTIFICATION**

- A. Use symbols, nomenclature and equipment numbers specified, shown on the drawings and shown in the maintenance manuals. Identification for piping is specified in Section 09 91 00, PAINTING.
- B. Interior (Indoor) Equipment: Engraved nameplates, with letters not less than 48 mm (3/16-inch) high of brass with black-filled letters, or rigid black plastic with white letters specified in Section 09 91 00, PAINTING permanently fastened to the equipment. Identify unit components such as coils, filters, fans, etc.
- C. Valve Tags and Lists:
  - 1. Valve tags: Engraved black filled numbers and letters not less than 13 mm (1/2-inch) high for number designation, and not less than 6.4 mm (1/4-inch) for service designation on 19 gage 38 mm (1-1/2 inches) round brass disc, attached with brass "S" hook or brass chain.
  - 2. Valve lists: Typed or printed plastic coated card(s), sized 216 mm (8-1/2 inches) by 280 mm (11 inches) showing tag number, valve function and area of control, for each service or system. Punch sheets for a 3-ring notebook.
  - 3. Provide detailed plan for each floor of the building indicating the location and valve number for each valve. Identify location of each valve with a color coded thumb tack in ceiling.

**2.3 FIRESTOPPING**

Section 07 84 00, FIRESTOPPING specifies an effective barrier against the spread of fire, smoke and gases where penetrations occur for piping.

**2.4 GALVANIZED REPAIR COMPOUND**

Mil. Spec. DOD-P-21035B, paint form.

**2.5 PIPE PENETRATIONS**

- A. Install sleeves during construction for other than blocked out floor openings for risers in mechanical bays.
- B. To prevent accidental liquid spills from passing to a lower level, provide the following:
  - 1. For sleeves: Extend sleeve 25 mm (one inch) above finished floor and provide sealant for watertight joint.

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2. For blocked out floor openings: Provide 40 mm (1-1/2 inch) angle set in silicone adhesive around opening.
3. For drilled penetrations: Provide 40 mm (1-1/2 inch) angle ring or square set in silicone adhesive around penetration.
- C. Penetrations are not allowed through beams or ribs, but may be installed in concrete beam flanges. Any deviation from this requirement must receive prior approval of Resident Engineer.
- D. Sheet Metal, Plastic, or Moisture-resistant Fiber Sleeves: Provide for pipe passing through floors, interior walls, and partitions, unless brass or steel pipe sleeves are specifically called for below.
- E. Cast Iron or Zinc Coated Pipe Sleeves: Provide for pipe passing through exterior walls below grade. Make space between sleeve and pipe watertight with a modular or link rubber seal. Seal shall be applied at both ends of sleeve.
- F. Galvanized Steel or an alternate Black Iron Pipe with asphalt coating Sleeves: Provide for pipe passing through concrete beam flanges, except where brass pipe sleeves are called for. Provide sleeve for pipe passing through floor of mechanical rooms, laundry work rooms, and animal rooms above basement. Except in mechanical rooms, connect sleeve with floor plate.
- G. Brass Pipe Sleeves: Provide for pipe passing through quarry tile, terrazzo or ceramic tile floors. Connect sleeve with floor plate.
- H. Sleeves are not required for wall hydrants for fire department connections or in drywall construction.
- I. Sleeve Clearance: Sleeve through floors, walls, partitions, and beam flanges shall be one inch greater in diameter than external diameter of pipe. Sleeve for pipe with insulation shall be large enough to accommodate the insulation. Interior openings shall be caulked tight with fire stopping material and sealant to prevent the spread of fire, smoke, and gases.
- J. Sealant and Adhesives: Shall be as specified in Section 07 92 00, JOINT SEALANTS.

**2.6 TOOLS AND LUBRICANTS**

- A. Furnish, and turn over to the Resident Engineer, special tools not readily available commercially, that are required for disassembly or adjustment of equipment and machinery furnished.
- B. Grease Guns with Attachments for Applicable Fittings: One for each type of grease required for each motor or other equipment.

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- C. Tool Containers: Hardwood or metal, permanently identified for intended service and mounted, or located, where directed by the Resident Engineer.
- D. Lubricants: A minimum of 0.95 L (one quart) of oil, and 0.45 kg (one pound) of grease, of equipment manufacturer's recommended grade and type, in unopened containers and properly identified as to use for each different application.

**2.7 WALL, FLOOR AND CEILING PLATES**

- A. Material and Type: Chrome plated brass or chrome plated steel, one piece or split type with concealed hinge, with set screw for fastening to pipe, or sleeve. Use plates that fit tight around pipes, cover openings around pipes and cover the entire pipe sleeve projection.
- B. Thickness: Not less than 2.4 mm (3/32-inch) for floor plates. For wall and ceiling plates, not less than 0.64 mm (0.025-inch) for up to 80 mm (3-inch pipe), 0.89 mm (0.035-inch) for larger pipe.
- C. Locations: Use where pipe penetrates floors, walls and ceilings in exposed locations, in finished areas only. Use also where insulation ends on exposed water supply pipe drop from overhead. Provide a watertight joint in spaces where brass or steel pipe sleeves are specified.

**PART 3 - EXECUTION**

**3.1 INSTALLATION**

- A. Coordinate location of piping, sleeves, inserts, hangers, and equipment. Locate piping, sleeves, inserts, hangers, and equipment clear of windows, doors, openings, light outlets, and other services and utilities. Follow manufacturer's published recommendations for installation methods not otherwise specified.
- B. Protection and Cleaning:
  - 1. Equipment and materials shall be carefully handled, properly stored, and adequately protected to prevent damage before and during installation, in accordance with the manufacturer's recommendations and as approved by the Resident Engineer. Damaged or defective items in the opinion of the Resident Engineer, shall be replaced.
  - 2. Protect all finished parts of equipment, such as shafts and bearings where accessible, from rust prior to operation by means of protective grease coating and wrapping. Close pipe openings with caps or plugs during installation. Tightly cover and protect equipment against dirt, water chemical, or mechanical injury. At completion of all work thoroughly exposed materials and equipment.

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- C. Concrete and Grout: Use concrete and shrink compensating grout 25 MPa (3000 psi) minimum, specified in Section 03 30 00, CAST-IN-PLACE CONCRETE.
- D. Install gages, valves, and other devices with due regard for ease in reading or operating and maintaining said devices. Locate and position gages to be easily read by operator or staff standing on floor or walkway provided. Servicing shall not require dismantling adjacent equipment or pipe work.
- E. Work in Existing Building:
  - 1. Perform as specified in Article, OPERATIONS AND STORAGE AREAS, Article, ALTERATIONS, and Article, RESTORATION of the Section 01 00 00, GENERAL REQUIREMENTS for relocation of existing equipment, alterations and restoration of existing building(s).
  - 2. As specified in Section 01 00 00, GENERAL REQUIREMENTS, Article, OPERATIONS AND STORAGE AREAS, make alterations to existing service piping at times that will least interfere with normal operation of the facility.
  - 3. Cut required openings through existing masonry and reinforced concrete using diamond core drills. Use of pneumatic hammer type drills, impact type electric drills, and hand or manual hammer type drills, will be permitted only with approval of the Resident Engineer. Locate openings that will least effect structural slabs, columns, ribs or beams. Refer to the Resident Engineer for determination of proper design for openings through structural sections and opening layouts approval, prior to cutting or drilling into structure. After Resident Engineer's approval, carefully cut opening through construction no larger than absolutely necessary for the required installation.
- F. Switchgear Drip Protection: Every effort shall be made to eliminate the installation of pipe above electrical and telephone switchgear. If this is not possible, encase pipe in a second pipe with a minimum of joints.
- G. Inaccessible Equipment:
  - 1. Where the Government determines that the Contractor has installed equipment not conveniently accessible for operation and maintenance, equipment shall be removed and reinstalled or remedial action performed as directed at no additional cost to the Government.
  - 2. The term "conveniently accessible" is defined as capable of being reached without the use of ladders, or without climbing or crawling under or over obstacles such as motors, fans, pumps, belt guards, transformers, high voltage lines, piping, and ductwork.



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**3.2 LUBRICATION**

Field check and lubricate equipment requiring lubrication prior to initial operation.

**3.3 OPERATING AND PERFORMANCE TESTS**

- A. Prior to the final inspection, perform required tests as specified in Section 01 00 00, GENERAL REQUIREMENTS, Article, TESTS and submit the test reports and records to the Resident Engineer.
- B. Should evidence of malfunction in any tested system, or piece of equipment or component part thereof, occur during or as a result of tests, make proper corrections, repairs or replacements, and repeat tests at no additional cost to the Government.
- C. When completion of certain work or system occurs at a time when final control settings and adjustments cannot be properly made to make performance tests, then make performance tests for heating systems and for cooling systems respectively during first actual seasonal use of respective systems following completion of work.

**3.4 INSTRUCTIONS TO VA PERSONNEL**

Provide in accordance with Article, INSTRUCTIONS, of Section 01 00 00, GENERAL REQUIREMENTS.

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**SECTION 21 10 00  
WATER-BASED FIRE-SUPPRESSION SYSTEMS**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

- A. The design and installation of a hydraulically calculated automatic fire sprinkler system complete and ready for operation, for the entire renovation area including mechanical equipment rooms and accessible shafts.
- B. Modification of the existing sprinkler systems as indicated on the drawings.
- C. Existing piping to be reused, replaced or removed as indicated on the drawings. Removal of piping to include all valves, flow switches, supervisory devices, hangers, supports, and associated fire alarm system conduit and wire.
- D. Replacement of all existing sprinklers. Work to include all necessary piping modifications, new sprinklers and new sprinkler escutcheons.
- E. Provide access doors or panels where control or drain valves are located behind plaster or gypsum walls or ceilings as necessary to install piping above suspended plaster or gypsum ceilings.
- F. Painting of exposed piping and supports to follow Section 09 91 00, PAINTING.

**1.2 RELATED WORK**

- A. Treatment of penetrations through rated enclosures: Section 07 84 00, FIRESTOPPING.
- B. Access panels for plaster ceilings: Section 08 31 13, ACCESS DOORS AND FRAMES.
- C. Painting of exposed pipe: Section 09 91 00, PAINTING.
- D. Section 21 05 11, COMMON WORK RESULTS FOR FIRE SUPPRESSION.
- E. Alarm Supervision: Section 28 31 00, FIRE DETECTION AND ALARM.
- F. Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

**1.3 DESIGN CRITERIA**

- A. The design, materials, equipment, installation, inspection, and testing of the automatic sprinkler system shall be in accordance with the required advisory provisions of NFPA 13, 14, 20, 25, 75, 82, .

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B. Base system design hydraulic calculations using the area/density method on the following criteria and in accordance with NFPA 13 latest edition.

1. Sprinkler Protection:

- a. All patient care, treatment, office, waiting areas, educational areas, dining areas, and corridors: Light hazard, (0.10 gpm/sq. ft.) over the hydraulically most remote 140 m<sup>2</sup> (1500 sq. ft.).
- b. Mechanical Equipment Rooms, Electric Closets, and storage between 9 and 23 m<sup>2</sup> (100 and 250 sq. ft.): Ordinary Hazard, Group 1, 6.1 L/minute/m<sup>2</sup> (0.15 gpm/sq. ft.) over the hydraulically most remote 140 m<sup>2</sup> (1500 sq. ft.).
- c. Clean and soiled linen rooms, trash rooms, clean and soiled utility rooms, and storage rooms, storage room over 23 m<sup>2</sup> (250 sq. ft.): Ordinary Group 2, 8.1 L/minute/m<sup>2</sup> (0.20 gpm/sq. ft.) over the hydraulically most remote 140 m<sup>2</sup> (1500 sq. ft.).
- d. Provide sprinklers in accessible shafts per NFPA 13 latest edition.

2. Add water allowance of 15 L/s (250 gpm) for inside and outside hose streams to the sprinkler requirements at the connection to the distribution main.

3. Hydraulic Calculations: The calculated demand including hose stream requirements shall fall no less than 10 percent below the available supply curve.

4. Water Supply:

- a. Fire Pump Test
- b. 145PSI with 488GPM flow
- c. 135 PSI with 796GPM flow

C. For each sprinkler zone provide a control valve, flow switch, self-contained test, drain assembly and pressure gage.

D. Provide a guard for each sprinkler in the janitors' closets and sprinklers within 2100 mm (7 ft.) of the floor and other areas as required by NFPA 13.

E. Seismic Protection: Seismically brace all new and existing piping systems in accordance with Zone D of NFPA 13 latest edition.

**1.4 QUALIFICATIONS:**

A. Designer's Qualifications: Design work and shop drawings shall be prepared by a licensed engineer practicing in the field of Fire

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Protection Engineering or a NICET (National Institute for Certification in Engineering Technologies) Level III sprinkler technician.

B. Installer's Qualifications: The installer shall possess a valid State fire protection contractor's license. The installer shall provide documentation of having successfully completed three projects of similar size and scope.

C. On-site emergency service within four hours notification.

**1.5 SUBMITTALS**

A. Submit as one package in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. Sprinkler design shall be done by a certified professional. All plans shall be stamped by qualified P.E.

C. Emergency service point of contact name and 24 hour emergency telephone number.

D. Manufacturer's Literature and Data:

1. Pipe and fittings.
2. Valves.
3. Drips.
4. Sprinklers-each type, temperature and model.
5. Inspectors Test Alarm Modules.
6. Sprinkler Cabinets.
7. Sprinkler Plugs.
8. Pressure Gages.
9. Pipe Hangers and Supports.
10. Water Flow Switches.
11. Valve Tamper Switches.

E. Detailed drawings in accordance with NFPA 13 the latest editions. Drawings shall be prepared using CADD software stamped by fire protection professional engineer and include all new and existing sprinklers and piping. Use format in use at the VA medical center. Drawings are subject to change during the bidding and construction periods. Any wall and ceiling changes occurring prior to the submittal of contractors shop drawings shall be incorporated into the contractors detailed design at no additional contract cost.

F. Hydraulic calculations for each sprinkler system in accordance with NFPA 13 latest edition.

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G. Operation and Maintenance Data:

1. Indicating Valves.
2. Water Flow and valve tamper switches.
3. Copy of NFPA 25.

H. Recommended preventive maintenance schedule.

**1.6 AS-BUILT DOCUMENTATION**

- A. A Mylar as-built drawing and two blue-line copies shall be provided for each drawing. One copy of final CADD drawing files shall also be provided on 89 mm (3 1/2 in.), 1.44 mb diskette, for each drawing.
- B. Four sets of manufacturer's literature and data updated to include submittal review comments and any equipment substitutions.
- C. Four sets of hydraulic calculations for each sprinkler system updated to include submittal review comments and any changes to the installation which affect the calculations including one electronic set in PDF format.
- D. Four copies of the hydrostatic report and NFPA 13 material and test certificate for each sprinkler system.
- E. Four sets of operation and maintenance data updated to include submittal review comments and any equipment substitutions including one copy of NFPA 25.
- F. Manufacturers literature, hydraulic calculations, reports and operation and maintenance data shall be in a labeled 3-ring binder.

**1.7 WARRANTY**

- A. All work performed and materials and equipment furnished under this contract shall be free from defects for a period of one year from date of acceptance by the government.
- B. All new piping and equipment incorporated into the new system shall be hydrostatically tested and warranted as new.

**1.8 APPLICABLE PUBLICATIONS**

- A. Publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.
- B. National Fire Protection Association (NFPA)
  - 13-2010 .....Installation of Sprinkler Systems
  - 14-2010 .....Installation of Standpipe and Hose Systems
  - 17A-2009 .....Standard for wet chemical extinguishing systems

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- 25-2011 .....Inspection, Testing and Maintenance of water  
Based Fire Protection Systems
- 70-2011 .....National Electrical Code
- 72-2010 .....National Fire Alarm Code
- 170-2009 .....Standards for Fire Safety Symbols
- C. Underwriters Laboratories Inc. (UL)
- 2011 .....Fire Protection Equipment Directory
- D. Factory Mutual Engineering Corporation (FM)
- 2010 .....Approval Guide
- E. American Society for Testing and Materials (ASTM)
- F442-09 .....Chlorinated Poly (Vinyl Chloride) (CPVC)  
Plastic Pipe
- F. American Society of Sanitary Engineering (ASSE)
- 1015-2009 .....Double Check Backflow Prevention Assembly
- G. Complete maintenance and inspection service for the sprinkler systems  
shall be provided by a factory trained authorized representative of the  
manufacturer of the major equipment for a period of one year after  
acceptance of the entire installation by the government.
- H. Contractor shall provide all necessary test equipment, parts and labor  
to perform required maintenance.
- I. All inspections, testing and maintenance work required by NFPA 25, NFPA  
20, NFPA 13 and recommended by the equipment manufacturer shall be  
provided. Work shall include operation of sprinkler system alarm and  
supervisory devices.
- J. Maintenance and testing shall be performed on a quarterly basis. A  
computerized preventive maintenance schedule shall be provided and  
shall describe the protocol for preventive maintenance of equipment.  
The schedule shall include a systematic examination, adjustment, and  
cleaning of all equipment.
- K. Non-included Work: Maintenance service shall not include the  
performance of any work due to improper use, accidents or negligence  
for what the contractor is not responsible.
- L. Service and emergency personnel shall report to the Engineering Office  
or their authorized representative upon arrival at the hospital and  
again upon the completion of the required work. A copy of the work  
ticket containing a complete description of work performed and parts  
replaced shall be provided.

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**M. Emergency Service:**

1. Normal and overtime emergency call-back service shall consist of an on-site response to calls within four hours of notification.
2. Overtime emergency call-back service shall be limited to minor adjustments and repairs to affect the integrity of the system.

**PART 2 - PRODUCTS**

**2.1 GENERAL**

All devices and equipment shall be Underwriters Laboratories Inc. listed for their intended purpose. All sprinklers shall be Factory Mutual approved.

**2.2 PIPING AND FITTINGS**

- A. Sprinkler piping downstream of the isolation valve on wet-pipe systems shall be per NFPA 13 black steel, schedule 10 minimum.
- B. Threaded or flanged fittings shall be ANSI B1 6.3 cast iron, class 125 minimum. Threaded fittings are not permitted on pipe with wall thickness less than schedule 40.
- C. Slip type or clamp-on type rubber gasketed fittings shall be listed for each piping application.
- D. Piping Materials Standards:
  1. Welded and seamless steel pipe - follow ANSI/ASTM A 53
  2. Wrought steel pipe - follow ANSI/ASME B36.10M
  3. Alloy material - follow ASTM B 446
- E. Fitting Materials Standards:
  1. Cast iron threaded fitting, Class 125 and 250 - follow ASME B16.4
  2. Cast iron pipe flanges and flanged fittings - follow ASME B16.1
  3. Malleable iron threaded fittings, Class 150 and 300 steel - follow ASME B16.3
  4. Factory made wrought steel butt weld fittings - follow ASME B16.9
  5. Buttwelding ends for pipe, valves, flanges, and fitting - follow ASME B16.25
- F. Pipe Identification - All pipe, including specially listed pipe allowed by NFPA 13, shall be marked continuously along its length by the manufacturer in such a way as to properly identify the type of pipe. Pipe identification shall include the manufacturer's name, model designation, or schedule.



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**2.3 VALVES**

A. Listed Indicating Valves:

1. Butterfly: Gear operated, indicating type, 2400 kPa (350 psi) water working pressure (WWP). Butterfly valves are to be installed in a manner that does not interfere with the operation of any system component.
2. Ball (inspectors test and drain only): iron body, stainless steel trim, for 2050 kPa (300 psi) service, indicating type.

B. Check Valves: Swing type, rubber faced or wafer type spring loaded butterfly check valve, 2400 kPa (350 lb.) water working pressure (WWP).

C. Drain Valves: Threaded bronze angle, globe, ball or butterfly, 4100 kPa (600 psi), Water or gas (WOG) equipped with reducer and hose connection with cap or connected to a drain line.

D. Self-contained Test and Drain Valve:

1. Ductile iron body with bronze "Drain" and "Test" bonnets. Acrylic sight glass for viewing test flow. Various sized orifice inserts to simulate flow through 14 mm (17/32 in.), 13 mm (1/2 in.), 12 mm (7/16 in.), and 10 mm (3/8 in.) diameter sprinklers, 32 mm (1 1/4 in.) female threaded outlets or 32 mm (1 1/4 in.) one-quarter turn locking lug outlets for plain end pipe (end preparation to be in accordance with manufacturer's recommendation).
2. Bronze body, with chrome plated bronze ball, brass stem, steel handle, Teflon seat and sight glasses. Provide valve with three position indicator plate (off, test, and drain), 6 mm (1/4 in.) tapping for pressure gage and various other orifice inserts to simulate flow through 10 mm (3/8 in.), 12 mm (7/16 in.), 13 mm (1/2 in.), and 14 mm (17/32 in.) diameter sprinklers.

**2.4 SPRINKLERS**

- A. Quick response sprinklers shall be standard type except as noted below. The maximum distance from the deflector to finished ceiling shall be 50 mm (2 in.) for pendent sprinklers. Pendent sprinklers in finished areas shall be provided with semi-recessed adjustable screwed escutcheons and installed within the center one-third of their adjustment. The sprinkler shall be installed in the flush position with the element exposed below the ceiling line. At the specified locations, provide the following type of sprinklers. All sprinklers shall be FM approved. Maximum break away strength shall be certified by the

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manufacturer to be no more than 39 kPa (85 pounds). Provide quick response sprinklers in all areas, except where specifically prohibited by their listing or approval, and the following:

LOCATION	TYPE
Mechanical Equipment Rooms, Electrical Rooms	Quick Response, Upright or Telephone Closets, Transformer Vaults Pendent Brass [93 °C (200 °F)]
	Standard Upright or Sidewall Brass [93 °C (200 °F)]
All Patient Treatment, Elevator Lobbies and Corridors	Quick Response, Recessed Pendent, Chrome Plated [66-74 °C [150- 165 °F)]
All Areas Not Listed Above	Quick Response, Recessed Pendent, Sidewall, Chrome Plated [66-74 °C (150-165 °F)]

B. Do not use quick response sprinklers in the same sprinkler zone with other sprinklers types.

C. Sprinklers to be installed as per NFPA 13.

## **2.5 TOOLS AND REPLACEMENT PARTS**

A. Sprinkler Cabinet:

1. Provide a minimum 5 percent spare sprinklers with escutcheons with a minimum of two of each type/or as required by NFPA-13, whichever is more demanding.
2. Provide a minimum of two of each type sprinkler wrenches used.
3. Install cabinets in each building where directed by the Resident Engineer.
4. Spare sprinklers shall be kept in a cabinet where ambient temperatures do not exceed 100 Deg F.

B. Provide two sprinkler plugs attached to multi-section extension poles 2400 mm (8 ft.) minimum.

## **2.6 IDENTIFICATION SIGNS**

Provide for all new and existing sectional valves, riser control valves, system control valves, drain valves, test and drain connections and alarm devices with securely attached identification signs (enamel on metal) in accordance with NFPA 13.

## **2.7 HANGERS AND EARTHQUAKE BRACING**

In accordance with NFPA 13 and 14. Comply with seismic requirements as per 15050 for seismic zone locations.

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**2.8 WATERFLOW SWITCHES**

- A. Integral, mechanical, non-coded, non-accumulative retard type, with two sets of SPDT auxiliary contacts and adjustable from 0 to 90 seconds.  
Set flow switches at an initial setting between 20 and 30 seconds.
- B. All conduit and wiring connected thereto shall be provided in Section 28 31 00, FIRE DETECTION AND ALARM.

**2.9 VALVE SUPERVISORY SWITCHES**

- A. Provide each indicating sprinkler control valve with adequate means for mounting a valve supervisory switch.
- B. Mount switch so as not to interfere with normal operation of the valve and adjust to operate within two revolutions toward the closed position of the valve control, or when the stem is moved no more than one fifth of the distance from its normal position.
- C. The mechanism shall be contained in a weatherproof die cast aluminum housing, which shall provide a 20 mm (3/4 in.) tapped conduit entrance and incorporate the necessary facilities for attachment to the valves.
- D. Switch housing to be finished in red baked enamel.
- E. Supervisory switches for ball and butterfly valves may be integral with the valve.
- F. All conduit and wiring connected thereto shall be provided in Section 28 31 00, FIRE DETECTION AND ALARM.

**2.10 WALL, FLOOR AND CEILING PLATES**

- A. Exposed piping passing through walls, floors or ceilings shall be provided with chrome colored escutcheon plates.
- B. Comply with NFPA 101 Fire Barrier Penetration codes.

**2.11 PRESSURE GAUGE**

- A. Provide a 1280 kPa (200 psi) pressure gauge at each flow alarm switch location, at each main drain connection pump.

**2.12 HANGERS**

- A. Hangers shall be designed to support five times the weight of the water filled pipe plus 250 Lb (114Kg) at each point of piping support.
- B. These points of support shall be adequate to support the system.
- C. The spacing between hangers shall not exceed the value given for the type of pipe as indicated in NFPA 13 tables.
- D. Hanger components shall be ferrous.
- E. Detailed calculations shall be submitted, when required by the reviewing

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Authority, showing stress developed in hangers, piping, fittings and safety factors allowed.

**PART 3 - EXECUTION**

**3.1 INSTALLATION**

- A. Supervisory Switches: For each indicating sprinkler zone, control valve, provide a supervisory switch that is connected to the fire alarm system.
- B. Waterflow Switches: For each sprinkler zone and where indicated on drawings, provide a waterflow switch. Install waterflow switch and adjacent valves in easily accessible locations.
- C. Sprinkler Zone: Each sprinkler zone shall coincide with each smoke zone.
- D. Drains, Test Pipes and Accessories:
  - 1. Provide a drain connection on valved sections, and drains at other locations for complete drainage of the system. Provide valve in drain lines and connect to the central drain riser.
  - 2. Provide test pipes in accordance with NFPA 13. Test pipes shall be valved and piped to discharge through proper orifice as specified above for drains.
- E. Provide a 1280 kPa (200 psi) pressure gage at each flow alarm switch location.
- F. Conceal all piping, except in stairwells and rooms without ceilings.
- G. Install new piping and sprinklers aligned with natural building and other sprinklers lines.
- H. Locate piping in stairways as near ceiling as possible to prevent tampering by unauthorized personnel. Provide a minimum headroom of 2250 mm (7 ft.-6 in.) for all piping.
- I. Piping arrangement shall avoid contact with other piping and equipment and allow clear access to other equipment or devices requiring access or maintenance.
- J. Cutout disks, which are created by cutting holes in the walls of pipe for flow switches and non-threaded pipe connections, shall be affixed near to the pipe where the originated. They shall be displayed until final inspection and then removed.
- K. Firestopping shall comply with Section 07 84 00, FIRESTOPPING. All holes through stairways, smoke barrier walls, and fire walls shall be sealed on a daily basis.

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- L. Provide hydraulic design information signage as required by NFPA 13 and 14.
- M. Install access doors in ceilings of rooms where above ceiling access is required.

**3.2 TEST**

- A. Automatic Sprinkler System: NFPA 13 and 25.

**3.3 INSTRUCTIONS**

Furnish the services of a competent instructor for not less than two four-hour periods for instructing personnel in the operation and maintenance of the sprinkler system, on the dates requested by the COTR.

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SECTION 22 05 11  
COMMON WORK RESULTS FOR PLUMBING

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

- A. The requirements of this Section shall apply to all sections of Division 22.
- B. Definitions:
  - 1. Exposed: Piping and equipment exposed to view in finished rooms.
  - 2. Option or optional: Contractor's choice of an alternate material or method.

**1.2 RELATED WORK**

- A. Section 01 00 00, GENERAL REQUIREMENTS.
- B. Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- C. Section 02 82 11, TRADITIONAL ASBESTOS ABATEMENT.
- D. Section 03 30 00, CAST-IN-PLACE CONCRETE: Concrete and Grout.
- E. Section 05 50 00, METAL FABRICATIONS.
- F. Section 07 84 00, FIRESTOPPING.
- G. Section 07 60 00, FLASHING AND SHEET METAL: Flashing for Wall and Roof Penetrations.
- H. Section 07 92 00, JOINT SEALANTS.
- I. Section 09 91 00, PAINTING.
- J. Section 13 05 41, SEISMIC RESTRAINT REQUIREMENTS FOR NON-STRUCTURAL COMPONENTS
- K. Section 23 07 11, HVAC, PLUMBING, AND BOILER PLANT INSULATION.
- L. Section 23 09 23, DIRECT DIGITAL CONTROLS FOR HVAC.
- M. Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS

**1.3 QUALITY ASSURANCE**

- A. Products Criteria:
  - 1. Standard Products: Material and equipment shall be the standard products of a manufacturer regularly engaged in the manufacture of the products for at least 3 years. However, digital electronics devices, software and systems such as controls, instruments, computer work station, shall be the current generation of technology and basic design that has a proven satisfactory service record of at least three years.
  - 2. Equipment Service: There shall be permanent service organizations, authorized and trained by manufacturers of the equipment supplied,

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- located within 160 km (100 miles) of the project. These organizations shall come to the site and provide acceptable service to restore operations within four hours of receipt of notification by phone, e-mail or fax in event of an emergency, such as the shut-down of equipment; or within 24 hours in a non-emergency. Names, mail and e-mail addresses and phone numbers of service organizations providing service under these conditions for (as applicable to the project): pumps, critical instrumentation, computer workstation and programming shall be submitted for project record and inserted into the operations and maintenance manual.
3. All items furnished shall be free from defects that would adversely affect the performance, maintainability and appearance of individual components and overall assembly.
  4. The products and execution of work specified in Division 22 shall conform to the referenced codes and standards as required by the specifications. Local codes and amendments enforced by the local code official shall be enforced, if required by local authorities such as the natural gas supplier. If the local codes are more stringent, then the local code shall apply. Any conflicts shall be brought to the attention of the Resident Engineer (RE)/Contracting Officers Technical Representative (COTR).
  5. Multiple Units: When two or more units of materials or equipment of the same type or class are required, these units shall be products of one manufacturer.
  6. Assembled Units: Manufacturers of equipment assemblies, which use components made by others, assume complete responsibility for the final assembled product.
  7. Nameplates: Nameplate bearing manufacturer's name or identifiable trademark shall be securely affixed in a conspicuous place on equipment, or name or trademark cast integrally with equipment, stamped or otherwise permanently marked on each item of equipment.
  8. Asbestos products or equipment or materials containing asbestos shall not be used.



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- B. Welding: Before any welding is performed, contractor shall submit a certificate certifying that welders comply with the following requirements:
1. Qualify welding processes and operators for piping according to ASME "Boiler and Pressure Vessel Code", Section IX, "Welding and Brazing Qualifications".
  2. Comply with provisions of ASME B31 series "Code for Pressure Piping".
  3. Certify that each welder has passed American Welding Society (AWS) qualification tests for the welding processes involved, and that certification is current.
  4. All welds shall be stamped according to the provisions of the American Welding Society.
- C. Manufacturer's Recommendations: Where installation procedures or any part thereof are required to be in accordance with the recommendations of the manufacturer of the material being installed, printed copies of these recommendations shall be furnished to the Resident Engineer prior to installation. Installation of the item will not be allowed to proceed until the recommendations are received. Failure to furnish these recommendations can be cause for rejection of the material.
- D. Execution (Installation, Construction) Quality:
1. All items shall be applied and installed in accordance with manufacturer's written instructions. Conflicts between the manufacturer's instructions and the contract drawings and specifications shall be referred to the RE/COTR for resolution. Written hard copies or computer files of manufacturer's installation instructions shall be provided to the RE/COTR at least two weeks prior to commencing installation of any item.
  2. Complete layout drawings shall be required by Paragraph, SUBMITTALS. Construction work shall not start on any system until the layout drawings have been approved.
- E. Guaranty: Warranty of Construction, FAR clause 52.246-21.
- F. Plumbing Systems: IPC, International Plumbing Code.

**1.4 SUBMITTALS**

- A. Submittals shall be submitted in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, and SAMPLES.

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- B. Information and material submitted under this section shall be marked "SUBMITTED UNDER SECTION 22 05 11, COMMON WORK RESULTS FOR PLUMBING", with applicable paragraph identification.
- C. Contractor shall make all necessary field measurements and investigations to assure that the equipment and assemblies will meet contract requirements.
- D. If equipment is submitted which differs in arrangement from that shown, provide drawings that show the rearrangement of all associated systems. Approval will be given only if all features of the equipment and associated systems, including accessibility, are equivalent to that required by the contract.
- E. Prior to submitting shop drawings for approval, contractor shall certify in writing that manufacturers of all major items of equipment have each reviewed drawings and specifications, and have jointly coordinated and properly integrated their equipment and controls to provide a complete and efficient installation.
- F. Upon request by Government, lists of previous installations for selected items of equipment shall be provided. Contact persons who will serve as references, with telephone numbers and e-mail addresses shall be submitted with the references.
- G. Manufacturer's Literature and Data: Manufacturer's literature shall be submitted under the pertinent section rather than under this section.
  - 1. Electric motor data and variable speed drive data shall be submitted with the driven equipment.
  - 2. Equipment and materials identification.
  - 3. Fire stopping materials.
  - 4. Hangers, inserts, supports and bracing. Provide load calculations for variable spring and constant support hangers.
  - 5. Wall, floor, and ceiling plates.
- H. Coordination Drawings: Complete consolidated and coordinated layout drawings shall be submitted for all new systems, and for existing systems that are in the same areas. The drawings shall include plan views, elevations and sections of all systems and shall be on a scale of not less than 1:32 (3/8-inch equal to one foot). Clearly identify and dimension the proposed locations of the principal items of equipment. The drawings shall clearly show the proposed location and adequate clearance for all equipment, piping, pumps, valves and other

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items. All valves, trap primer valves, water hammer arrestors, strainers, and equipment requiring service shall be provided with an access door sized for the complete removal of plumbing device, component, or equipment. Equipment foundations shall not be installed until equipment or piping until layout drawings have been approved. Detailed layout drawings shall be provided for all piping systems. In addition, details of the following shall be provided.

1. Mechanical equipment rooms.
2. Interstitial space.
3. Hangers, inserts, supports, and bracing.
4. Pipe sleeves.
5. Equipment penetrations of floors, walls, ceilings, or roofs.

**I. Maintenance Data and Operating Instructions:**

1. Maintenance and operating manuals in accordance with Section 01 00 00, GENERAL REQUIREMENTS, Article, INSTRUCTIONS, for systems and equipment.
2. Listing of recommended replacement parts for keeping in stock supply, including sources of supply, for equipment shall be provided.
3. The listing shall include belts for equipment: Belt manufacturer, model number, size and style, and distinguished whether of multiple belt sets.

**1.5 DELIVERY, STORAGE AND HANDLING**

**A. Protection of Equipment:**

1. Equipment and material placed on the job site shall remain in the custody of the Contractor until phased acceptance, whether or not the Government has reimbursed the Contractor for the equipment and material. The Contractor is solely responsible for the protection of such equipment and material against any damage.
2. Damaged equipment shall be replaced with an identical unit as determined and directed by the RE/COTR. Such replacement shall be at no additional cost to the Government.
3. Interiors of new equipment and piping systems shall be protected against entry of foreign matter. Both inside and outside shall be cleaned before painting or placing equipment in operation.

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4. Existing equipment and piping being worked on by the Contractor shall be under the custody and responsibility of the Contractor and shall be protected as required for new work.

**B. Cleanliness of Piping and Equipment Systems:**

1. Care shall be exercised in the storage and handling of equipment and piping material to be incorporated in the work. Debris arising from cutting, threading and welding of piping shall be removed.
2. Piping systems shall be flushed, blown or pigged as necessary to deliver clean systems.
3. The interior of all tanks shall be cleaned prior to delivery and beneficial use by the Government. All piping shall be tested in accordance with the specifications and the International Plumbing Code (IPC), latest edition. All filters, strainers, fixture faucets shall be flushed of debris prior to final acceptance.
4. Contractor shall be fully responsible for all costs, damage, and delay arising from failure to provide clean systems.

**1.6 APPLICABLE PUBLICATIONS**

- A. The publications listed below shall form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.

**B. American Society of Mechanical Engineers (ASME):**

Boiler and Pressure Vessel Code (BPVC):

SEC IX-2007 .....Boiler and Pressure Vessel Code; Section IX,  
Welding and Brazing Qualifications.

**C. American Society for Testing and Materials (ASTM):**

A36/A36M-2008 .....Standard Specification for Carbon Structural  
Steel

A575-96 (R 2007) .....Standard Specification for Steel Bars, Carbon,  
Merchant Quality, M-Grades R (2002)

E84-2005 .....Standard Test Method for Surface Burning  
Characteristics of Building Materials

E119-2008a .....Standard Test Methods for Fire Tests of  
Building Construction and Materials

**D. Manufacturers Standardization Society (MSS) of the Valve and Fittings Industry, Inc:**

SP-58-02 .....Pipe Hangers and Supports-Materials, Design and  
Manufacture

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SP 69-2003 (R 2004) ....Pipe Hangers and Supports-Selection and  
Application

E. National Electrical Manufacturers Association (NEMA):

MG1-2003, Rev. 1-2007 ..Motors and Generators

F. International Code Council, (ICC):

IBC-06, (R 2007) .....International Building Code

IPC-06, (R 2007) .....International Plumbing Code

**PART 2 - PRODUCTS**

**2.1 FACTORY-ASSEMBLED PRODUCTS**

A. STANDARDIZATION OF COMPONENTS SHALL BE MAXIMIZED TO REDUCE SPARE PART requirements.

B. Manufacturers of equipment assemblies that include components made by others shall assume complete responsibility for final assembled unit.

1. All components of an assembled unit need not be products of same manufacturer.

2. Constituent parts that are alike shall be products of a single manufacturer.

3. Components shall be compatible with each other and with the total assembly for intended service.

4. Contractor shall guarantee performance of assemblies of components, and shall repair or replace elements of the assemblies as required to deliver specified performance of the complete assembly.

C. Components of equipment shall bear manufacturer's name and trademark, model number, serial number and performance data on a name plate securely affixed in a conspicuous place, or cast integral with, stamped or otherwise permanently marked upon the components of the equipment.

D. Major items of equipment, which serve the same function, shall be the same make and model

**2.2 COMPATIBILITY OF RELATED EQUIPMENT**

A. Equipment and materials installed shall be compatible in all respects with other items being furnished and with existing items so that the result will be a complete and fully operational system that conforms to contract requirements.

**2.3 EQUIPMENT AND MATERIALS IDENTIFICATION**

A. Use symbols, nomenclature and equipment numbers specified, shown on the drawings, or shown in the maintenance manuals. Identification for piping is specified in Section 09 91 00, PAINTING.

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B. Interior (Indoor) Equipment: Engraved nameplates, with letters not less than 48 mm (3/16-inch) high of brass with black-filled letters, or rigid black plastic with white letters specified in Section 09 91 00, PAINTING shall be permanently fastened to the equipment. Unit components such as water heaters, tanks, coils, filters, fans, etc. shall be identified.

C. Valve Tags and Lists:

1. Plumbing: All valves shall be provided with valve tags and listed on a valve list (Fixture stops not included).
2. Valve tags: Engraved black filled numbers and letters not less than 13 mm (1/2-inch) high for number designation, and not less than 6.4 mm (1/4-inch) for service designation on 19 gage, 38 mm (1-1/2 inches) round brass disc, attached with brass "S" hook or brass chain.
3. Valve Lists: Valve lists shall be created using a word processing program and printed on plastic coated cards. The plastic coated valve list card(s), sized 216 mm (8-1/2 inches) by 280 mm (11 inches) shall show valve tag number, valve function and area of control for each service or system. The valve list shall be in a punched 3-ring binder notebook. A copy of the valve list shall be mounted in picture frames for mounting to a wall.
4. A detailed plan for each floor of the building indicating the location and valve number for each valve shall be provided. Each valve location shall be identified with a color coded sticker or thumb tack in ceiling.

**2.4 FIRE STOPPING**

A. Section 07 84 00, FIRESTOPPING specifies an effective barrier against the spread of fire, smoke and gases where penetrations occur for piping. Refer to Section 23 07 11, HVAC, PLUMBING, AND BOILER PLANT INSULATION, for pipe insulation.

**2.5 GALVANIZED REPAIR COMPOUND**

A. Mil. Spec. DOD-P-21035B, paint.

**2.6 PIPE AND EQUIPMENT SUPPORTS AND RESTRAINTS**

A. In lieu of the paragraph which follows, suspended equipment support and restraints may be designed and installed in accordance with the International Building Code (IBC), latest edition, and SECTION 13 05 41, SEISMIC RESTRAINT REQUIREMENTS FOR NON-STRUCTURAL COMPONENTS.

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Submittals based on the International Building Code (IBC), latest edition, SECTION 13 05 41 requirements, or the following paragraphs of this Section shall be stamped and signed by a professional engineer registered in a state where the project is located. The Support system of suspended equipment over 227 kg (500 pounds) shall be submitted for approval of the Resident Engineer in all cases. See these specifications for lateral force design requirements.

- B. Type Numbers Specified: MSS SP-58. For selection and application refer to MSS SP-69. Refer to Section 05 50 00, METAL FABRICATIONS, for miscellaneous metal support materials and prime coat painting.
- C. For Attachment to Concrete Construction:
  - 1. Concrete insert: Type 18, MSS SP-58.
  - 2. Self-drilling expansion shields and machine bolt expansion anchors: Permitted in concrete not less than 102 mm (4 inches) thick when approved by the Resident Engineer for each job condition.
  - 3. Power-driven fasteners: Permitted in existing concrete or masonry not less than 102 mm (4 inches) thick when approved by the Resident Engineer for each job condition.
- D. For Attachment to Steel Construction: MSS SP-58.
  - 1. Welded attachment: Type 22.
  - 2. Beam clamps: Types 20, 21, 28 or 29. Type 23 C-clamp may be used for individual copper tubing up to 23 mm (7/8-inch) outside diameter.
- E. For Attachment to Wood Construction: Wood screws or lag bolts.
- F. Hanger Rods: Hot-rolled steel, ASTM A36 or A575 for allowable load listed in MSS SP-58. For piping, provide adjustment means for controlling level or slope. Types 13 or 15 turn-buckles shall provide 38 mm (1-1/2 inches) minimum of adjustment and incorporate locknuts. All-thread rods are acceptable.
- G. Multiple (Trapeze) Hangers: Galvanized, cold formed, lipped steel channel horizontal member, not less than 41 mm by 41 mm (1-5/8 inches by 1-5/8 inches), 2.7 mm (No. 12 gage), designed to accept special spring held, hardened steel nuts. Trapeze hangers are not permitted for steam supply and condensate piping.
  - 1. Allowable hanger load: Manufacturers rating less 91kg (200 pounds).
  - 2. Guide individual pipes on the horizontal member of every other trapeze hanger with 6 mm (1/4-inch) U-bolt fabricated from steel rod. Provide Type 40 insulation shield, secured by two 13 mm

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(1/2-inch) galvanized steel bands, or insulated calcium silicate shield for insulated piping at each hanger.

H. Pipe Hangers and Supports: (MSS SP-58), use hangers sized to encircle insulation on insulated piping. Refer to Section 23 07 11, HVAC, PLUMBING, and BOILER PLANT INSULATION for insulation thickness. To protect insulation, provide Type 39 saddles for roller type supports or insulated calcium silicate shields. Provide Type 40 insulation shield or insulated calcium silicate shield at all other types of supports and hangers including those for insulated piping.

1. General Types (MSS SP-58):

- a. Standard clevis hanger: Type 1; provide locknut.
- b. Riser clamps: Type 8.
- c. Wall brackets: Types 31, 32 or 33.
- d. Roller supports: Type 41, 43, 44 and 46.
- e. Saddle support: Type 36, 37 or 38.
- f. Turnbuckle: Types 13 or 15.
- g. U-bolt clamp: Type 24.
- h. Copper Tube:

- 1) Hangers, clamps and other support material in contact with tubing shall be painted with copper colored epoxy paint, plastic coated or taped with isolation tape to prevent electrolysis.
- 2) For vertical runs use epoxy painted or plastic coated riser clamps.
- 3) For supporting tube to strut: Provide epoxy painted pipe straps for copper tube or plastic inserted vibration isolation clamps.
- 4) Insulated Lines: Provide pre-insulated calcium silicate shields sized for copper tube.

2. Plumbing Piping (Other Than General Types):

- a. Horizontal piping: Type 1, 5, 7, 9, and 10.
- b. Chrome plated piping: Chrome plated supports.
- c. Hangers and supports in pipe chase: Prefabricated system ABS self-extinguishing material, not subject to electrolytic action, to hold piping, prevent vibration and compensate for all static and operational conditions.



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- d. Blocking, stays and bracing: Angle iron or preformed metal channel shapes, 1.3 mm (18 gage) minimum.
- I. Pre-insulated Calcium Silicate Shields:
  - 1. Provide 360 degree water resistant high density 965 kPa (140 psi) compressive strength calcium silicate shields encased in galvanized metal.
  - 2. Pre-insulated calcium silicate shields to be installed at the point of support during erection.
  - 3. Shield thickness shall match the pipe insulation.
  - 4. The type of shield is selected by the temperature of the pipe, the load it must carry, and the type of support it will be used with.
    - a. Shields for supporting cold water shall have insulation that extends a minimum of one inch past the sheet metal.
    - b. The insulated calcium silicate shield shall support the maximum allowable water filled span as indicated in MSS-SP 69. To support the load, the shields shall have one or more of the following features: structural inserts 4138 kPa (600 psi) compressive strength, an extra bottom metal shield, or formed structural steel (ASTM A36) wear plates welded to the bottom sheet metal jacket.
  - 5. Shields may be used on steel clevis hanger type supports, roller supports or flat surfaces.
- J. Seismic Restraint of Piping: Refer to Section 13 05 41, SEISMIC RESTRAINT REQUIREMENTS FOR NON-STRUCTURAL COMPONENTS.

**2.7 PIPE PENETRATIONS**

- A. Pipe penetration sleeves shall be installed for all pipe other than rectangular blocked out floor openings for risers in mechanical bays.
- B. Pipe penetration sleeve materials shall comply with all fire stopping requirements for each penetration.
- C. To prevent accidental liquid spills from passing to a lower level, provide the following:
  - 1. For sleeves: Extend sleeve 25 mm (1 inch) above finished floor and provide sealant for watertight joint.
  - 2. For blocked out floor openings: Provide 40 mm (1-1/2 inch) angle set in silicone adhesive around opening.
  - 3. For drilled penetrations: Provide 40 mm (1-1/2 inch) angle ring or square set in silicone adhesive around penetration.

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- C. Penetrations are not allowed through beams or ribs, but may be installed in concrete beam flanges. Any deviation from these requirements must receive prior approval of Resident Engineer.
- D. Sheet metal, plastic, or moisture resistant fiber sleeves shall be provided for pipe passing through floors, interior walls, and partitions, unless brass or steel pipe sleeves are specifically called for below.
- E. Cast iron or zinc coated pipe sleeves shall be provided for pipe passing through exterior walls below grade. The space between the sleeve and pipe shall be made watertight with a modular or link rubber seal. The link seal shall be applied at both ends of the sleeve.
- F. Galvanized steel or an alternate black iron pipe with asphalt coating sleeves shall be for pipe passing through concrete beam flanges, except where brass pipe sleeves are called for. A galvanized steel Sleeve shall be provided for pipe passing through floor of mechanical rooms above basement. Except in mechanical rooms, sleeves shall be connected with a floor plate.
- G. Brass Pipe Sleeves shall be provided for pipe passing through quarry tile, terrazzo or ceramic tile floors. The sleeve shall be connected with a floor plate.
- H. Sleeve clearance through floors, walls, partitions, and beam flanges shall be 25 mm (1 inch) greater in diameter than external diameter of pipe. Sleeve for pipe with insulation shall be large enough to accommodate the insulation plus 25 mm (1 inch) in diameter. Interior openings shall be caulked tight with fire stopping material and sealant to prevent the spread of fire, smoke, and gases.
- I. Sealant and Adhesives: Shall be as specified in Section 07 92 00, JOINT SEALANTS.

**2.8 TOOLS AND LUBRICANTS**

- A. Furnish, and turn over to the Resident Engineer, special tools not readily available commercially, that are required for disassembly or adjustment of equipment and machinery furnished.
- B. Grease Guns with Attachments for Applicable Fittings: One for each type of grease required for each motor or other equipment.
- C. Tool Containers: metal, permanently identified for intended service and mounted, or located, where directed by the Resident Engineer.

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- D. Lubricants: A minimum of 0.95 L (1 quart) of oil, and 0.45 kg (1 pound) of grease, of equipment manufacturer's recommended grade and type, in unopened containers and properly identified as to use for each different application.

**2.9 WALL, FLOOR AND CEILING PLATES**

- A. Material and Type: Chrome plated brass or chrome plated steel, one piece or split type with concealed hinge, with set screw for fastening to pipe, or sleeve. Use plates that fit tight around pipes, cover openings around pipes and cover the entire pipe sleeve projection.
- B. Thickness: Not less than 2.4 mm (3/32-inch) for floor plates. For wall and ceiling plates, not less than 0.64 mm (0.025-inch) for up to 80 mm (3 inch) pipe, 0.89 mm (0.035-inch) for larger pipe.
- C. Locations: Use where pipe penetrates floors, walls and ceilings in exposed locations, in finished areas only. Wall plates shall be used where insulation ends on exposed water supply pipe drop from overhead. A watertight joint shall be provided in spaces where brass or steel pipe sleeves are specified.

**2.10 ASBESTOS**

Materials containing asbestos are not permitted.

**PART 3 - EXECUTION**

**3.1 ARRANGEMENT AND INSTALLATION OF EQUIPMENT AND PIPING**

- A. Location of piping, sleeves, inserts, hangers, and equipment, access provisions shall be coordinated with the work of all trades. Piping, sleeves, inserts, hangers, and equipment shall be located clear of windows, doors, openings, light outlets, and other services and utilities. Equipment layout drawings shall be prepared to coordinate proper location and personnel access of all facilities. The drawings shall be submitted for review.

Manufacturer's published recommendations shall be followed for installation methods not otherwise specified.

- B. Operating Personnel Access and Observation Provisions: All equipment and systems shall be arranged to provide clear view and easy access, without use of portable ladders, for maintenance and operation of all devices including, but not limited to: all equipment items, valves, filters, strainers, transmitters, sensors, control devices. All gages and indicators shall be clearly visible by personnel standing on the floor or on permanent platforms. Maintenance and operating space and

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access provisions that are shown on the drawings shall not be changed nor reduced.

C. Structural systems necessary for pipe and equipment support shall be coordinated to permit proper installation.

D. Location of pipe sleeves, trenches and chases shall be accurately coordinated with equipment and piping locations.

E. Cutting Holes:

1. Holes through concrete and masonry shall be cut by rotary core drill. Pneumatic hammer, impact electric, and hand or manual hammer type drill will not be allowed, except as permitted by RE/COTR where working area space is limited.

2. Holes shall be located to avoid interference with structural members such as beams or grade beams. Holes shall be laid out in advance and drilling done only after approval by RE/COTR. If the Contractor considers it necessary to drill through structural members, this matter shall be referred to RE/COTR for approval.

3. Waterproof membrane shall not be penetrated. Pipe floor penetration block outs shall be provided outside the extents of the waterproof membrane.

F. Minor Piping: Generally, small diameter pipe runs from drips and drains, water cooling, and other service are not shown but must be provided.

G. Protection and Cleaning:

1. Equipment and materials shall be carefully handled, properly stored, and adequately protected to prevent damage before and during installation, in accordance with the manufacturer's recommendations and as approved by the Resident Engineer. Damaged or defective items in the opinion of the Resident Engineer, shall be replaced.

2. Protect all finished parts of equipment, such as shafts and bearings where accessible, from rust prior to operation by means of protective grease coating and wrapping. Close pipe openings with caps or plugs during installation. Pipe openings, equipment, and plumbing fixtures shall be tightly covered against dirt or mechanical injury. At completion of all work thoroughly clean fixtures, exposed materials and equipment.

H. Concrete and Grout: Concrete and shrink compensating grout 25 MPa (3000 psi) minimum, specified in Section 03 30 00, CAST-IN-PLACE CONCRETE

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shall be used for all pad or floor mounted equipment. Gages, thermometers, valves and other devices shall be installed with due regard for ease in reading or operating and maintaining said devices. Thermometers and gages shall be located and positioned to be easily read by operator or staff standing on floor or walkway provided. Servicing shall not require dismantling adjacent equipment or pipe work.

- I. Many plumbing systems interface with the HVAC control system. See the HVAC control points list and section 23 09 23 DIRECT DIGITAL CONTROLS FOR HVAC
- J. Work in Existing Building:
  - 1. Perform as specified in Article, OPERATIONS AND STORAGE AREAS, Article, ALTERATIONS, and Article, RESTORATION of the Section 01 00 00, GENERAL REQUIREMENTS for relocation of existing equipment, alterations and restoration of existing building(s).
  - 2. As specified in Section 01 00 00, GENERAL REQUIREMENTS, Article, OPERATIONS AND STORAGE AREAS, make alterations to existing service piping at times that will cause the least interfere with normal operation of the facility.
- K. Work in bathrooms, restrooms, housekeeping closets: All pipe penetrations behind escutcheons shall be sealed with plumbers putty.
- L. Switchgear Drip Protection: Every effort shall be made to eliminate the installation of pipe above electrical and telephone switchgear. If this is not possible, encase pipe in a second pipe with a minimum of joints.
- M. Inaccessible Equipment:
  - 1. Where the Government determines that the Contractor has installed equipment not conveniently accessible for operation and maintenance, equipment shall be removed and reinstalled or remedial action performed as directed at no additional cost to the Government.
  - 2. The term "conveniently accessible" is defined as capable of being reached without the use of ladders, or without climbing or crawling under or over obstacles such as electrical conduit, motors, fans, pumps, belt guards, transformers, high voltage lines, piping, and ductwork.

**3.2 TEMPORARY PIPING AND EQUIPMENT**

- A. Continuity of operation of existing facilities may require temporary installation or relocation of equipment and piping. Temporary

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equipment or pipe installation or relocation shall be provided to maintain continuity of operation of existing facilities.

- B. The Contractor shall provide all required facilities in accordance with the requirements of phased construction and maintenance of service. All piping and equipment shall be properly supported, sloped to drain, operate without excessive stress, and shall be insulated where injury can occur to personnel by contact with operating facilities. The requirements of Para. 3.1 shall apply.
- C. Temporary facilities and piping shall be completely removed and any openings in structures sealed. Necessary blind flanges and caps shall be provided to seal open piping remaining in service.

**3.3 RIGGING**

- A. Openings in building structures shall be planned to accommodate design scheme.
- B. Alternative methods of equipment delivery may be offered and will be considered by Government under specified restrictions of phasing and service requirements as well as structural integrity of the building.
- C. All openings in the building shall be closed when not required for rigging operations to maintain proper environment in the facility for Government operation and maintenance of service.
- D. Contractor shall provide all facilities required to deliver specified equipment and place on foundations. Attachments to structures for rigging purposes and support of equipment on structures shall be Contractor's full responsibility.
- E. Contractor shall check all clearances, weight limitations and shall provide a rigging plan designed by a Registered Professional Engineer. All modifications to structures, including reinforcement thereof, shall be at Contractor's cost, time and responsibility.
- F. Rigging plan and methods shall be referred to RE/COTR for evaluation prior to actual work.

**3.4 PIPE AND EQUIPMENT SUPPORTS**

- A. Where hanger spacing does not correspond with joist or rib spacing, use structural steel channels secured directly to joist and rib structure that will correspond to the required hanger spacing, and then suspend the equipment and piping from the channels. Holes shall be drilled or burned in structural steel ONLY with the prior written approval of the Resident Engineer.

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- B. The use of chain pipe supports, wire or strap hangers; wood for blocking, stays and bracing, or hangers suspended from piping above shall not be permitted. Rusty products shall be replaced.
- C. Hanger rods shall be used that are straight and vertical. Turnbuckles for vertical adjustments may be omitted where limited space prevents use. A minimum of 15 mm (1/2-inch) clearance between pipe or piping covering and adjacent work shall be provided.
- D. For horizontal and vertical plumbing pipe supports, refer to the International Plumbing Code (IPC), latest edition, and these specifications.
- E. Overhead Supports:
  - 1. The basic structural system of the building is designed to sustain the loads imposed by equipment and piping to be supported overhead.
  - 2. Provide steel structural members, in addition to those shown, of adequate capability to support the imposed loads, located in accordance with the final approved layout of equipment and piping.
  - 3. Tubing and capillary systems shall be supported in channel troughs.

**3.5 LUBRICATION**

- A. All equipment and devices requiring lubrication shall be lubricated prior to initial operation. All devices and equipment shall be field checked for proper lubrication.
- B. All devices and equipment shall be equipped with required lubrication fittings. A minimum of one liter (one quart) of oil and 0.5 kg (one pound) of grease of manufacturer's recommended grade and type for each different application shall be provided. All materials shall be delivered to RE/COTR in unopened containers that are properly identified as to application.
- C. A separate grease gun with attachments for applicable fittings shall be provided for each type of grease applied.
- D. All lubrication points shall be accessible without disassembling equipment, except to remove access plates.
- E. All lubrication points shall be extended to one side of the equipment.

**3.6 PLUMBING SYSTEMS DEMOLITION**

- A. Rigging access, other than indicated on the drawings, shall be provided after approval for structural integrity by the RE/COTR. Such access shall be provided without additional cost or time to the Government. Where work is in an operating plant, approved protection from dust and

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debris shall be provided at all times for the safety of plant personnel and maintenance of plant operation and environment of the plant.

- B. In an operating plant, cleanliness and safety shall be maintained. The plant shall be kept in an operating condition. Government personnel will be carrying on their normal duties of operating, cleaning and maintaining equipment and plant operation. Work shall be confined to the immediate area concerned; maintain cleanliness and wet down demolished materials to eliminate dust. Dust and debris shall not be permitted to accumulate in the area to the detriment of plant operation. All flame cutting shall be performed to maintain the fire safety integrity of this plant. Adequate fire extinguishing facilities shall be available at all times. All work shall be performed in accordance with recognized fire protection standards. Inspections will be made by personnel of the VA Medical Center, and the Contractor shall follow all directives of the RE or COTR with regard to rigging, safety, fire safety, and maintenance of operations.
- C. Unless specified otherwise, all piping, wiring, conduit, and other devices associated with the equipment not re-used in the new work shall be completely removed from Government property. This includes all concrete equipment pads, pipe, valves, fittings, insulation, and all hangers including the top connection and any fastenings to building structural systems. All openings shall be sealed after removal of equipment, pipes, ducts, and other penetrations in roof, walls, floors, in an approved manner and in accordance with plans and specifications where specifically covered. Structural integrity of the building system shall be maintained. Reference shall also be made to the drawings and specifications of the other disciplines in the project for additional facilities to be demolished or handled.
- D. All valves including gate, globe, ball, butterfly and check, all pressure gages and thermometers with wells shall remain Government property and shall be removed and delivered to RE/COTR and stored as directed. The Contractor shall remove all other material and equipment, devices and demolition debris under these plans and specifications. Such material shall be removed from Government property expeditiously and shall not be allowed to accumulate.
- E. Asbestos Insulation Removal: Conform to Section 02 82 11, TRADITIONAL ASBESTOS ABATEMENT.



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**3.7 CLEANING AND PAINTING**

- A. Prior to final inspection and acceptance of the plant and facilities for beneficial use by the Government, the plant facilities, equipment and systems shall be thoroughly cleaned and painted. Refer to Section 09 91 00, PAINTING.
- B. In addition, the following special conditions apply:
  - 1. Cleaning shall be thorough. Solvents, cleaning materials and methods recommended by the manufacturers shall be used for the specific tasks. All rust shall be removed prior to painting and from surfaces to remain unpainted. Scratches, scuffs, and abrasions shall be repaired prior to applying prime and finish coats.
  - 2. The following Material and Equipment shall NOT be painted::
    - a. Regulators.
    - b. Pressure reducing valves.
    - c. Control valves and thermostatic elements.
    - d. Lubrication devices and grease fittings.
    - e. Copper, brass, aluminum, stainless steel and bronze surfaces.
    - f. Valve stems and rotating shafts.
    - g. Pressure gages and thermometers.
    - h. Glass.
    - i. Name plates.
  - 3. Temporary Facilities: Apply paint to surfaces that do not have existing finish coats.
  - 4. The final result shall be a smooth, even-colored, even-textured factory finish on all items. The entire piece of equipment shall be repainted, if necessary, to achieve this.

**3.8 IDENTIFICATION SIGNS**

- A. Laminated plastic signs, with engraved lettering not less than 5 mm (3/16-inch) high, shall be provided that designates equipment function, for all equipment, switches, motor controllers, relays, meters, control devices, including automatic control valves. Nomenclature and identification symbols shall correspond to that used in maintenance manual, and in diagrams specified elsewhere. Attach by chain, adhesive, or screws.
- B. Factory Built Equipment: Metal plate, securely attached, with name and address of manufacturer, serial number, model number, size, performance shall be placed on factory built equipment.

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C. Pipe Identification: Refer to Section 09 91 00, PAINTING.

**3.9 OPERATING AND PERFORMANCE TESTS**

- A. Prior to the final inspection, all required tests shall be performed as specified in Section 01 00 00, GENERAL REQUIREMENTS, Article, TESTS and submit the test reports and records to the Resident Engineer.
- B. Should evidence of malfunction in any tested system, or piece of equipment or component part thereof, occur during or as a result of tests, make proper corrections, repairs or replacements, and repeat tests at no additional cost to the Government.
- C. When completion of certain work or system occurs at a time when final control settings and adjustments cannot be properly made to make performance tests, then make performance tests such systems respectively during first actual seasonal use of respective systems following completion of work.

**3.10 OPERATION AND MAINTENANCE MANUALS**

- A. Provide four bound copies. The Operations and maintenance manuals shall be delivered to RE/COTR not less than 30 days prior to completion of a phase or final inspection.
- B. All new and temporary equipment and all elements of each assembly shall be included.
- C. Manufacturer's installation, maintenance, repair, and operation instructions for each device shall be included. Assembly drawings and parts lists shall also be included. A summary of operating precautions and reasons for precautions shall be included in the Operations and Maintenance Manual.
- D. Lubrication instructions, type and quantity of lubricant shall be included.
- E. Schematic diagrams and wiring diagrams of all control systems corrected to include all field modifications shall be included.
- F. Emergency procedures.

**3.11 INSTRUCTIONS TO VA PERSONNEL**

Instructions shall be provided in accordance with Article, INSTRUCTIONS, of Section 01 00 00, GENERAL REQUIREMENTS.

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SECTION 22 05 23  
GENERAL-DUTY VALVES FOR PLUMBING PIPING

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

- A. This section describes the requirements for general-duty valves for domestic water and sewer systems.

**1.2 RELATED WORK**

- A. Section 22 05 11, COMMON WORK RESULTS FOR PLUMBING.

**1.3 SUBMITTALS**

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, and SAMPLES.
- B. Manufacturer's Literature and Data:
1. Valves.
  2. Backflow Preventers.
  3. Pressure Reducing Valves

**1.4 APPLICABLE PUBLICATIONS**

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.
- B. American Society for Testing and Materials (ASTM):A536-84(R 2004)  
Standard Specification for Ductile Iron Castings
- C. American Society of Sanitary Engineering (ASSE)  
ASSE 1003-01 (R 2003) ..Performance Requirements for Water Pressure Reducing Valves  
ASSE 1012-02 .....Backflow Preventer with Intermediate Atmospheric Vent  
ASSE 1013-05 .....Reduced Pressure Principle Backflow Preventers and Reduced Pressure Fire Protection Principle Backflow Preventers
- D. International Code Council (ICC)  
IPC-06 (R 2007) .....International Plumbing Code
- E. Manufacturers Standardization Society of the Valve and Fittings Industry, Inc. (MSS):  
SP-25-98 .....Standard Marking System for Valves, Fittings, Flanges and UnionsSP-67-02a (R 2004) Butterfly Valve of the Single flange Type (Lug Wafer)

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SP-70-06 .....Cast Iron Gate Valves, Flanged and Threaded  
Ends.

SP-72-99 .....Ball Valves With Flanged or Butt Welding For  
General Purpose

SP-80-03 .....Bronze Gate, Globe, Angle and Check Valves.

SP-110-96 .....Ball Valve Threaded, Socket Welding, Solder  
Joint, Grooved and Flared Ends

**1.5 DELIVERY, STORAGE, AND HANDLING**

A. Valves shall be prepared for shipping as follows:

1. Protect internal parts against rust and corrosion.
2. Protect threads, flange faces, grooves, and weld ends.
3. Set angle, gate, and globe valves closed to prevent rattling.
4. Set ball and plug valves open to minimize exposure of functional surfaces
5. Set butterfly valves closed or slightly open.
6. Block check valves in either closed or open position.

B. Valves shall be prepared for storage as follows:

1. Maintain valve end protection.
2. Store valves indoors and maintain at higher than ambient dew point temperature.

C. A sling shall be used for large valves. The sling shall be rigged to avoid damage to exposed parts. Hand wheels or stems shall not be used as lifting or rigging points.

**PART 2 - PRODUCTS**

**2.1 VALVES**

- A. Asbestos packing and gaskets are prohibited.
- B. Bronze valves shall be made with dezincification resistant materials. Bronze valves made with copper alloy (brass) containing more than 15 percent zinc shall not be permitted.
- C. Valves in insulated piping shall have 50 mm or DN50 (2 inch) stem extensions and extended handles of non-thermal conductive material that allows operating the valve without breaking the vapor seal or disturbing the insulation. Memory stops shall be fully adjustable after insulation is applied.
- D. Exposed Valves over 65 mm or DN65 (2-1/2 inches) installed at an elevation over 3.6 meters (12 feet) shall have a chain-wheel attachment to valve hand-wheel, stem, or other actuator.

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E. Ball valves, pressure regulating valves, gate valves, globe valves, and plug valves used to supply potable water shall meet the requirements of NSF 61.

F. Shut-off:

1. Cold, Hot and Re-circulating Hot Water:

a. 50 mm or DN50 (2 inches) and smaller: Ball, MSS SP-72, SP-110, Ball valve shall be full port three piece or two piece with a union design with adjustable stem package. Threaded stem designs are not allowed. The ball valve shall have a SWP rating of 1035 kPa (150 psig) and a CWP rating of 4140 kPa (600 psig). The body material shall be Bronze ASTM B584, Alloy C844. The ends shall be solder,

b. Less than 100 mm DN100 (4 inches): Butterfly shall have an iron body with EPDM seal and aluminum bronze disc. The butterfly valve shall meet MSS SP-67, type I standard. The butterfly valve shall have a SWP rating of 1380 kPa (200 psig). The valve design shall be lug type suitable for bidirectional dead-end service at rated pressure. The body material shall meet ASTM A 536, ductile iron.

C. Balancing:

1. Hot Water Re-circulating, 80 mm or DN80 (3 inches) and smaller manual balancing valve shall be of bronze body, brass ball construction with glass and carbon filled TFE seat rings and designed for positive shutoff. The manual balancing valve shall have differential pressure read-out ports across the valve seat area. The read out ports shall be fitting with internal EPT inserts and check valves. The valve body shall have 8 mm or DN8 NPT (¼" NPT) tapped drain and purge port. The valves shall have memory stops that allow the valve to close for service and then reopened to set point without disturbing the balance position. All valves shall have calibrated nameplates to assure specific valve settings.

D. Check:

1. Check valves less than 80 mm or DN80 (3 inches) and smaller) shall be class 125, bronze swing check valves with non metallic Buna-N disc. The check valve shall meet MSS SP-80 Type 4 standard. The check valve shall have a CWP rating of 1380 kPa (200 psig). The check valve shall have a Y pattern horizontal body design with

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bronze body material conforming to ASTM B 62, solder joints, and PTFE or TFE disc.

**2.2 BACKFLOW PREVENTERS**

- A. A backflow prevention assembly shall be installed at any point in the plumbing system where the potable water supply comes in contact with a potential source of contamination. The backflow prevention assembly shall be ASSE 1013 listed and certified.
- B. Reduced pressure backflow preventers shall be installed in the following applications.
  - 1. Water make up to heating systems, and similar equipment consuming water.
  - 2. Atmospheric Vacuum Breaker: ASSE 1001
    - a. Hose bibs and sinks w/threaded outlets.
- C. The reduced pressure principle backflow prevention assembly shall be ASSE listed 1013 with full port OS&Y gate valves and an integral relief monitor switch. The main body and access cover shall be epoxy coated duct iron conforming to ASTM A536 grade 4. The seat ring and check valve shall be Noryl (NSF listed). The stem shall be stainless steel conforming to ASTM A276. The seat disc elastomer shall be EPDM. The checks and the relief valve shall be accessible for maintenance without removing the device from the line. An epoxy coated wye type strainer with flanged connections shall be installed on the inlet.
- D. The atmospheric vacuum breaker shall be ASSE listed 1001. The main body shall be either cast bronze. All internal polymers shall be NSF listed. The seat disc elastomer shall be silicone. The device shall be accessible for maintenance without removing the device from the service line. The installation shall not be in a concealed or inaccessible location or where the venting of water from the device during normal operation is deemed objectionable.
- E. The double check detector backflow prevention assembly shall be ASSE listed 1048 and supply with full port OS&Y gate valves. The main body and access cover shall be epoxy coated ductile iron conforming to ASTM A536 grade. The seat ring and check valve shall be Noryl (NSF listed). The stem shall be stainless steel conforming to ASTM A 276. The seat disc elastomers shall be EPDM. The first and second check valve shall be accessible for maintenance without removing the device from the line.

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**2.3 WATER PRESSURE REDUCING VALVE AND CONNECTIONS**

- A. 80 mm or DN80 (3 inches) or smaller: The pressure reducing valve shall consist of a bronze body and bell housing, a separate access cover for the plunger, and a bolt to adjust the downstream pressure. The bronze bell housing and access cap shall be threaded to the body and shall not require the use of ferrous screws. The assembly shall be of the balanced piston design and shall reduce pressure in both flow and no flow conditions. The assembly shall be accessible for maintenance without having to remove the body from the line.
- B. The regulator shall have a tap for pressure gauge.
- C. The regulator shall have a temperature rating of 100° C (210° F) for hot water or hot water return service. Pressure regulators shall have accurate pressure regulation to 6.9-kPa (+/- 1 psig).
- D. Setting: Entering water pressure, discharge pressure, capacity, size, and related measurements shall be as shown on the drawings.
- E. Connections Valves and Strainers: shut off valves shall be installed on each side of reducing valve and a bypass line equal in size to the regulator inlet pipe shall be installed with a normally closed globe valve. A strainer shall be installed on inlet side of, and same size as pressure reducing valve. A pressure gage shall be installed on the low pressure side of the line.

**PART 3 - EXECUTION**

**3.1 EXAMINATION**

- A. Valve interior shall be examined for cleanliness, freedom from foreign matter, and corrosion. Special packing materials shall be removed, such as blocks, used to prevent disc movement during shipping and handling.
- B. Valves shall be operated in positions from fully open to fully closed. Guides and seats shall be examined and made accessible by such operations.
- C. Threads on valve and mating pipe shall be examined for form and cleanliness.
- D. Mating flange faces shall be examined for conditions that might cause leakage. Bolting shall be checked for proper size, length, and material. Gaskets shall be verified for proper size and that its material composition is suitable for service and free from defects and damage.

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E. Do not attempt to repair defective valves; replace with new valves.

**3.2 VALVE INSTALLATION**

- A. Install valves with unions or flanges at each piece of equipment arranged to allow service, maintenance, and equipment removal without system shutdown.
- B. Valves shall be located for easy access and shall be provide with separate support. Valves shall be accessible with access doors when installed inside partitions or above hard ceilings.
- C. Valves shall be installed in horizontal piping with stem at or above center of pipe
- D. Valves shall be installed in a position to allow full stem movement.
- E. Check valves shall be installed for proper direction of flow and as follows:
  - 1. Swing Check Valves: In horizontal position with hinge pin level.

**3.3 ADJUSTING**

- A. Valve packing shall be adjusted or replaced after piping systems have been tested and put into service but before final adjusting and balancing. Replace valves shall be replaced if persistent leaking occurs.

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SECTION 22 07 11  
PLUMBING INSULATION

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Field applied insulation for thermal efficiency and condensation control for:
  - 1. Plumbing piping and equipment.
  - 2. Re-insulation of plumbing piping and equipment after asbestos abatement.
- B. Definitions
  - 1. ASJ: All service jacket, white finish facing or jacket.
  - 2. Air conditioned space: Space having air temperature and/or humidity controlled by mechanical equipment.
  - 3. Cold: Equipment or piping handling media at design temperature of 16 degrees C (60 degrees F) or below.
  - 4. Concealed: Piping above ceilings and in chases, and pipe spaces.
  - 5. Exposed: Piping and equipment exposed to view in finished areas including mechanical equipment rooms, shafts, and chases.
  - 6. FSK: Foil-scrim-kraft facing.
  - 7. Hot: Plumbing equipment or piping handling media above 41 degrees C (105 degrees F).
  - 8. Density:  $\text{kg/m}^3$  - kilograms per cubic meter (Pcf - pounds per cubic foot).
  - 9. Thermal conductance: Heat flow rate through materials.
    - a. Flat surface: Watts per square meter (BTU per hour per square foot).
    - b. Pipe or Cylinder: Watts per square meter (BTU per hour per linear foot).
  - 10. Thermal Conductivity (k): Watt per meter, per degree C (BTU per inch thickness, per hour, per square foot, per degree F temperature difference).
  - 11. Vapor Retarder (Vapor Barrier): A material which retards the transmission (migration) of water vapor. Performance of the vapor retarder is rated in terms of permeance (perms). For the purpose of this specification, vapor retarders shall have a maximum published permeance of 0.1 perms and vapor barriers shall have a maximum published permeance of 0.001 perms.

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12. R: Pump recirculation.

13. CW: Cold water.

14. HW: Hot water.

**1.2 RELATED WORK**

A. Section 07 84 00, FIRESTOPPING: Mineral fiber and bond breaker behind sealant.

B. Section 22 05 11, COMMON WORK RESULTS FOR PLUMBING: General mechanical requirements and items, which are common to more than one section of Division 22.

C. Section 22 05 19, METERS AND GAGES FOR PLUMBING PIPING and Section 22 05 23, GENERAL-DUTY VALVES FOR PLUMBING PIPING: Hot and cold water piping.

**1.3 QUALITY ASSURANCE**

A. Refer to article QUALITY ASSURANCE, in Section 22 05 11, COMMON WORK RESULTS FOR PLUMBING.

B. Criteria:

1. Comply with NFPA 90A, particularly paragraphs 4.3.3.1 through 4.3.3.6, 4.3.10.2.6, and 5.4.6.4, parts of which are quoted as follows:

**4.3.3.1** Pipe insulation and coverings, vapor retarder facings, adhesives, fasteners, tapes, unless otherwise provided for in 4.3.3.1.12 or 4.3.3.1.2, shall have, in the form in which they are used, a maximum flame spread index of 25 without evidence of continued progressive combustion and a maximum smoke developed index of 50 when tested in accordance with NFPA 255, Standard Method of Test of Surface Burning Characteristics of Building Materials.

**4.3.3.1.1** Where these products are to be applied with adhesives, they shall be tested with such adhesives applied, or the adhesives used shall have a maximum flame spread index of 25 and a maximum smoke developed index of 50 when in the final dry state. (See 4.2.4.2.)

**4.3.3.3** Pipe insulation and coverings shall not flame, glow, smolder, or smoke when tested in accordance with a similar test for pipe covering, ASTM C 411, Standard Test Method for Hot-Surface Performance of High-Temperature Thermal Insulation, at the temperature to which they are exposed in service.

**4.3.3.3.1** In no case shall the test temperature be below 121°C (250°F).

**4.3.10.2.6.3** Nonferrous fire sprinkler piping shall be listed as having a maximum peak optical density of 0.5 or less, an average optical density of 0.15 or less, and a maximum flame spread distance of 1.5 m (5 ft) or less when tested in accordance with

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UL 1887, Standard for Safety Fire Test of Plastic Sprinkler Pipe for Visible Flame and Smoke Characteristics.

4.3.10.2.6.7 Smoke detectors shall not be required to meet the provisions of this section.

2. Test methods: ASTM E84, UL 723, or NFPA 255.
3. Specified k factors are at 24 degrees C (75 degrees F) mean temperature unless stated otherwise. Where optional thermal insulation material is used, select thickness to provide thermal conductance no greater than that for the specified material. For pipe, use insulation manufacturer's published heat flow tables. For domestic hot water supply and return, run out insulation and condensation control insulation, no thickness adjustment need be made.
4. All materials shall be compatible and suitable for service temperature, and shall not contribute to corrosion or otherwise attack surface to which applied in either the wet or dry state.

**1.4 SUBMITTALS**

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Shop Drawings:
  1. All information, clearly presented, shall be included to determine compliance with drawings and specifications and ASTM, federal and military specifications.
    - a. Insulation materials: Specify each type used and state surface burning characteristics.
    - b. Insulation facings and jackets: Each type used.
    - c. Insulation accessory materials: Each type used.
    - d. Manufacturer's installation and fitting fabrication instructions for flexible unicellular insulation.
    - e. Make reference to applicable specification paragraph numbers for coordination.

**1.5 STORAGE AND HANDLING OF MATERIAL**

Store materials in clean and dry environment, pipe covering jackets shall be clean and unmarred. Place adhesives in original containers. Maintain ambient temperatures and conditions as required by printed instructions of manufacturers of adhesives, mastics and finishing cements.

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**1.6 APPLICABLE PUBLICATIONS**

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by basic designation only.
- B. Federal Specifications (Fed. Spec.):
- L-P-535E (2)-91 .....Plastic Sheet (Sheeting): Plastic Strip; Poly (Vinyl Chloride) and Poly (Vinyl Chloride - Vinyl Acetate), Rigid.
- C. Military Specifications (Mil. Spec.):
- MIL-A-3316C (2)-90 .....Adhesives, Fire-Resistant, Thermal Insulation
- MIL-A-24179A (1)-87 .....Adhesive, Flexible Unicellular-Plastic Thermal Insulation
- MIL-C-19565C (1)-88 .....Coating Compounds, Thermal Insulation, Fire-and Water-Resistant, Vapor-Barrier
- MIL-C-20079H-87 .....Cloth, Glass; Tape, Textile Glass; and Thread, Glass and Wire-Reinforced Glass
- D. American Society for Testing and Materials (ASTM):
- A167-04 .....Standard Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip
- B209-07 .....Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate
- C411-05 .....Standard test method for Hot-Surface Performance of High-Temperature Thermal Insulation
- C449-07 .....Standard Specification for Mineral Fiber Hydraulic-Setting Thermal Insulating and Finishing Cement
- C533-09 .....Standard Specification for Calcium Silicate Block and Pipe Thermal Insulation
- C534-08 .....Standard Specification for Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form
- C547-07 .....Standard Specification for Mineral Fiber pipe Insulation
- C552-07 .....Standard Specification for Cellular Glass Thermal Insulation

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- C553-08 .....Standard Specification for Mineral Fiber  
Blanket Thermal Insulation for Commercial and  
Industrial Applications
- C585-09 .....Standard Practice for Inner and Outer Diameters  
of Rigid Thermal Insulation for Nominal Sizes  
of Pipe and Tubing (NPS System) R (1998)
- C612-10 .....Standard Specification for Mineral Fiber Block  
and Board Thermal Insulation
- C1126-10 .....Standard Specification for Faced or Unfaced  
Rigid Cellular Phenolic Thermal Insulation
- C1136-10 .....Standard Specification for Flexible, Low  
Permeance Vapor Retarders for Thermal  
Insulation
- D1668-97a (2006) .....Standard Specification for Glass Fabrics (Woven  
and Treated) for Roofing and Waterproofing
- E84-10 .....Standard Test Method for Surface Burning  
Characteristics of Building  
Materials
- E119-09C .....Standard Test Method for Fire Tests of Building  
Construction and Materials
- E136-09 b .....Standard Test Methods for Behavior of Materials  
in a Vertical Tube Furnace at 750 degrees C  
(1380 F)
- E. National Fire Protection Association (NFPA):
- 101-09 .....Life Safety Code
- 251-06 .....Standard methods of Tests of Fire Endurance of  
Building Construction Materials
- 255-06 .....Standard Method of tests of Surface Burning  
Characteristics of Building Materials
- F. Underwriters Laboratories, Inc. (UL):
- 723 .....UL Standard for Safety Test for Surface Burning  
Characteristics of Building Materials with  
Revision of 08/03
- G. Manufacturer's Standardization Society of the Valve and Fitting  
Industry (MSS):
- SP58-2002 .....Pipe Hangers and Supports Materials, Design,  
and Manufacture

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**PART 2 - PRODUCTS**

**2.1 MINERAL FIBER OR FIBER GLASS**

- A. ASTM C612 (Board, Block), Class 1 or 2, density 48 kg/m<sup>3</sup> (3 pcf), k = 0.037 (.26) at 24 degrees C (75 degrees F), external insulation for temperatures up to 204 degrees C (400 degrees F).
- B. ASTM C553 (Blanket, Flexible) Type I, // Class B-3, Density 16 kg/m<sup>3</sup> (1 pcf), k = 0.045 (0.31) // Class B-5, Density 32 kg/m<sup>3</sup> (2 pcf), k = 0.04 (0.27) // at 24 degrees C (75 degrees F), for use at temperatures up to 204 degrees C (400 degrees F)
- C. ASTM C547 (Pipe Fitting Insulation and Preformed Pipe Insulation), Class 1, k = 0.037 (0.26) at 24 degrees C (75 degrees F), for use at temperatures up to 230 degrees C (450 degrees F) with an all service vapor retarder jacket with polyvinyl chloride premolded fitting covering.

**2.2 MINERAL WOOL OR REFRACTORY FIBER**

- A. Comply with Standard ASTM C612, Class 3, 450 degrees C (850 degrees F).

**2.3 RIGID CELLULAR PHENOLIC FOAM**

- A. Preformed (molded) pipe insulation, ASTM C1126, type III, grade 1, k = 0.021(0.15) at 10 degrees C (50 degrees F), for use at temperatures up to 121 degrees C (250 degrees F) with vapor retarder and all service vapor retarder jacket with polyvinyl chloride premolded fitting covering.
- B. Equipment Insulation, ASTM C 1126, type II, grade 1, k = 0.021 (0.15) at 10 degrees C (50 degrees F), for use at temperatures up to 121 degrees C (250 degrees F) with rigid cellular phenolic insulation and covering, and all service vapor retarder jacket.

**2.4 CELLULAR GLASS CLOSED-CELL**

- A. Comply with Standard ASTM C177, C518, density 120 kg/m<sup>3</sup> (7.5 pcf) nominal, k = 0.033 (0.29) at 24 degrees C (75 degrees F).
- B. Pipe insulation for use at temperatures up to 200 degrees C (400 degrees F) with all service vapor retarder jacket.

**2.5 FLEXIBLE ELASTOMERIC CELLULAR THERMAL**

ASTM C177, C518, k = 0.039 (0.27) at 24 degrees C (75 degrees F), flame spread not over 25, smoke developed not over 50, for temperatures from minus 4 degrees C (40 degrees F) to 93 degrees C (200 degrees F). No jacket required.

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**2.6 CALCIUM SILICATE**

- A. Preformed pipe Insulation: ASTM C533, Type I and Type II with indicator denoting asbestos-free material.
- B. Premolded Pipe Fitting Insulation: ASTM C533, Type I and Type II with indicator denoting asbestos-free material.
- C. Equipment Insulation: ASTM C533, Type I and Type II.
- D. Characteristics:

Insulation Characteristics		
ITEMS	TYPE I	TYPE II
Temperature, maximum degrees C (degrees F)	649 (1200)	927 (1700)
Density (dry), Kg/m <sup>3</sup> (lb/ ft <sup>3</sup> )	232 (14.5)	288 (18)
Thermal conductivity: Min W/ m K (Btu in/h ft <sup>2</sup> degrees F)@ mean temperature of 93 degrees C (200 degrees F)	0.059 (0.41)	0.078 (0.540)
Surface burning characteristics: Flame spread Index, Maximum	0	0
Smoke Density index, Maximum	0	0

**2.7 INSULATION FACINGS AND JACKETS**

- A. Vapor Retarder, higher strength with low water permeance  $\leq$  0.02 or less perm rating, Beach puncture 50 units for insulation facing on pipe insulation jackets. Facings and jackets shall be all service type (ASJ) or PVDC Vapor Retarder jacketing.
- B. ASJ jacket shall be white kraft bonded to 0.025 mm (1 mil) thick aluminum foil, fiberglass reinforced, with pressure sensitive adhesive closure. Comply with ASTM C1136. Beach puncture 50 units, Suitable for painting without sizing. Jackets shall have minimum 40 mm (1-1/2 inch) lap on longitudinal joints and minimum 75mm (3 inch) butt strip on end joints. Butt strip material shall be same as the jacket. Lap and butt strips shall be self-sealing type with factory-applied pressure sensitive adhesive.
- C. Vapor Retarder medium strength with low water vapor permeance of 0.02 or less perm rating), Beach puncture 25 units: Foil-Scrim-Kraft (FSK)

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or PVDC vapor retarder jacketing type for concealed ductwork and equipment.

- D. Glass Cloth Jackets: Presized, minimum 0.18 kg per square meter (7.8 ounces per square yard), 2000 kPa (300 psig) bursting strength with integral vapor retarder where required or specified. Weather proof if utilized for outside service.
- E. Factory composite materials may be used provided
- F. Pipe fitting insulation covering (jackets): Fitting covering shall be premolded to match shape of fitting and shall be polyvinyl chloride (PVC) conforming to Fed Spec L-P-335, composition A, Type II Grade GU, and Type III, minimum thickness 0.7 mm (0.03 inches). Provide color matching vapor retarder pressure sensitive tape.

**2.8 PIPE COVERING PROTECTION SADDLES**

- A. Cold pipe support: Premolded pipe insulation 180 degrees (half-shells) on bottom half of pipe at supports. Material shall be cellular glass or high density Polyisocyanurate insulation of the same thickness as adjacent insulation. Density of Polyisocyanurate insulation shall be a minimum of 48 kg/m<sup>3</sup> (3.0 pcf).

Nominal Pipe Size and Accessories Material (Insert Blocks)	
Nominal Pipe Size mm (inches)	Insert Blocks mm (inches)
Up through 125 (5)	150 (6) long
150 (6)	150 (6) long
200 (8), 250 (10), 300 (12)	225 (9) long
350 (14), 400 (16)	300 (12) long
450 through 600 (18 through 24)	350 (14) long

- B. Warm or hot pipe supports: Premolded pipe insulation (180 degree half-shells) on bottom half of pipe at supports. Material shall be high density Polyisocyanurate (for temperatures up to 149 degrees C [300 degrees F]), cellular glass or calcium silicate. Insulation at supports shall have same thickness as adjacent insulation. Density of Polyisocyanurate insulation shall be a minimum of 48 kg/m<sup>3</sup> (3.0 pcf).

**2.9 ADHESIVE, MASTIC, CEMENT**

- A. Mil. Spec. MIL-A-3316, Class 1: Jacket and lap adhesive and protective finish coating for insulation.
- B. Mil. Spec. MIL-A-3316, Class 2: Adhesive for laps and for adhering insulation to metal surfaces.



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- C. Mil. Spec. MIL-A-24179, Type II Class 1: Adhesive for installing flexible unicellular insulation and for laps and general use.
- D. Mil. Spec. MIL-C-19565, Type I: Protective finish for outdoor use.
- E. Mil. Spec. MIL-C-19565, Type I or Type II: Vapor barrier compound for indoor use.
- F. ASTM C449: Mineral fiber hydraulic-setting thermal insulating and finishing cement.
- G. Other: Insulation manufacturers' published recommendations.

**2.10 MECHANICAL FASTENERS**

- A. Pins, anchors: Welded pins, or metal or nylon anchors with galvanized steel or fiber washer, or clips. Pin diameter shall be as recommended by the insulation manufacturer.
- B. Staples: Outward clinching galvanized steel
- C. Wire: 1.3 mm thick (18 gage) soft annealed galvanized or 1.9 mm (14 gage) copper clad steel or nickel copper alloy.
- D. Bands: 13 mm (1/2 inch) nominal width, brass, galvanized steel, aluminum or stainless steel.

**2.11 REINFORCEMENT AND FINISHES**

- A. Glass fabric, open weave: ASTM D1668, Type III (resin treated) and Type I (asphalt treated).
- B. Glass fiber fitting tape: Mil. Spec MIL-C-20079, Type II, Class 1.
- C. Tape for Flexible Elastomeric Cellular Insulation: As recommended by the insulation manufacturer.
- D. Hexagonal wire netting: 25 mm (one inch) mesh, 0.85 mm thick (22 gage) galvanized steel.
- E. Corner beads: 50 mm (2 inch) by 50 mm (2 inch), 0.55 mm thick (26 gage) galvanized steel; or, 25 mm (1 inch) by 25 mm (1 inch), 0.47 mm thick (28 gage) aluminum angle adhered to 50 mm (2 inch) by 50 mm (2 inch) Kraft paper.
- F. PVC fitting cover: Fed. Spec L-P-535, Composition A, 11-86 Type II, Grade GU, with Form B Mineral Fiber insert, for media temperature 4 degrees C (40 degrees F) to 121 degrees C (250 degrees F). Below 4 degrees C (40 degrees F) and above 121 degrees C (250 degrees F). Provide double layer insert. Provide color matching vapor barrier pressure sensitive tape.

**2.12 FIRESTOPPING MATERIAL**

Other than pipe insulation, refer to Section 07 84 00 FIRESTOPPING.

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**2.13 FLAME AND SMOKE**

Unless shown otherwise all assembled systems shall meet flame spread 25 and smoke developed 50 rating as developed under ASTM, NFPA and UL standards and specifications. See paragraph 1.3 "Quality Assurance".

**PART 3 - EXECUTION**

**3.1 GENERAL REQUIREMENTS**

- A. Required pressure tests of piping joints and connections shall be completed and the work approved by the Resident Engineer for application of insulation. Surface shall be clean and dry with all foreign materials, such as dirt, oil, loose scale and rust removed.
- B. Except for specific exceptions, insulate all specified equipment, and piping (pipe, fittings, valves, accessories). Insulate each pipe individually. Do not use scrap pieces of insulation where a full length section will fit.
- C. Where removal of insulation of piping and equipment is required to comply with Section 02 82 11, TRADITIONAL ASBESTOS ABATEMENT and Section 02 82 13.13, GLOVEBAG ASBESTOS ABATEMENT, such areas shall be reinsulated to comply with this specification.
- D. Insulation materials shall be installed in a first class manner with smooth and even surfaces, with jackets and facings drawn tight and smoothly cemented down at all laps. Insulation shall be continuous through all sleeves and openings, except at fire dampers and duct heaters (NFPA 90A). Vapor retarders shall be continuous and uninterrupted throughout systems with operating temperature 16 degrees C (60 degrees F) and below. Lap and seal vapor barrier over ends and exposed edges of insulation. Anchors, supports and other metal projections through insulation on cold surfaces shall be insulated and vapor sealed for a minimum length of 150 mm (6 inches).
- E. Install vapor stops at all insulation terminations on either side of valves, pumps and equipment and particularly in straight lengths of pipe insulation.
- F. Construct insulation on parts of equipment such as cold water pumps and heat exchangers that must be opened periodically for maintenance or repair, so insulation can be removed and replaced without damage. Install insulation with bolted 1 mm thick (20 gage) galvanized steel or aluminum covers as complete units, or in sections, with all necessary supports, and split to coincide with flange/split of the equipment.

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- G. Insulation on hot piping and equipment shall be terminated square at items not to be insulated, access openings and nameplates. Cover all exposed raw insulation with white sealer or jacket material.
- H. Plumbing work not to be insulated:
  - 1. Piping and valves of fire protection system.
  - 2. Chromium plated brass piping.
  - 3. Small horizontal cold water branch runs in partitions to individual fixtures may be without insulation for maximum distance of 900 mm (3 feet).
- I. Apply insulation materials subject to the manufacturer's recommended temperature limits. Apply adhesives, mastic and coatings at the manufacturer's recommended minimum coverage.
- J. Elbows, flanges and other fittings shall be insulated with the same material as is used on the pipe straights.  
Use of polyurethane spray-foam to fill a PVC elbow jacket is prohibited on cold applications.
- K. Firestop Pipe insulation:
  - 1. Provide firestopping insulation at fire and smoke barriers through penetrations. Fire stopping insulation shall be UL listed as defines in Section 07 84 00, FIRESTOPPING.
  - 2. Pipe penetrations requiring fire stop insulation including, but not limited to the following:
    - a. Pipe risers through floors
    - b. Pipe chase walls and floors
    - c. Smoke partitions
    - d. Fire partitions

**3.2 INSULATION INSTALLATION**

- A. Molded Mineral Fiber Pipe and Tubing Covering:
  - 1. Fit insulation to pipe, aligning longitudinal joints. Seal longitudinal joint laps and circumferential butt strips by rubbing hard with a nylon sealing tool to assure a positive seal. Staples may be used to assist in securing insulation. Seal all vapor retarder penetrations on cold piping with a generous application of vapor barrier mastic. Provide inserts and install with metal insulation shields at outside pipe supports. Install freeze protection insulation over heating cable.

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2. Contractor's options for fitting, flange and valve insulation:

- a. Insulating and finishing cement for sizes less than 100 mm (4 inches) operating at surface temperature of 16 degrees C (61 degrees F) or more.
- b. Factory premolded, one piece PVC covers with mineral fiber, (Form B), inserts. Provide two insert layers for pipe temperatures below 4 degrees C (40 degrees F), or above 121 degrees C (250 degrees F). Secure first layer of insulation with twine. Seal seam edges with vapor barrier mastic and secure with fitting tape.
- c. Factory molded, ASTM C547 or field mitered sections, joined with adhesive or wired in place. For hot piping finish with a smoothing coat of finishing cement. For cold fittings, 16 degrees C (60 degrees F) or less, vapor seal with a layer of glass fitting tape imbedded between two 2 mm (1/16 inch) coats of vapor barrier mastic.
- d. Fitting tape shall extend over the adjacent pipe insulation and overlap on itself at least 50 mm (2 inches).

3. Nominal thickness in millimeters and inches specified in the schedule at the end of this section.

B. Rigid Cellular Phenolic Foam:

1. Rigid closed cell phenolic insulation may be provided for piping, ductwork and equipment for temperatures up to 121 degrees C (250 degrees F).
2. Note the NFPA 90A burning characteristics requirements of 25/50 in paragraph 1.3.B
3. Provide secure attachment facilities such as welding pins.
4. Apply insulation with joints tightly drawn together
5. Apply adhesives, coverings, neatly finished at fittings, and valves.
6. Final installation shall be smooth, tight, neatly finished at all edges.
7. Minimum thickness in millimeters (inches) specified in the schedule at the end of this section.

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8. Condensation control insulation: Minimum 25 mm (1.0 inch) thick for all pipe sizes.

a. Plumbing piping as follows:

- 1) Waste piping from electric water coolers and icemakers to drainage system.
- 2) Waste piping located above basement floor from ice making and film developing equipment and air handling units, from equipment(including trap) to main vertical waste pipe.
- 3) Cold water piping.

C. Cellular Glass Insulation:

1. Pipe and tubing, covering nominal thickness in millimeters and inches as specified in the schedule at the end of this section.

D. Polyisocyanurate Closed-Cell Rigid Insulation:

1. Polyisocyanurate closed-cell rigid insulation (PIR) may be provided for exterior piping and equipment for temperature up to 149 degree C (300 degree F.
2. Install insulation, vapor retarder and jacketing per manufacturer's recommendations. Particular attention should be paid to recommendations for joint staggering, adhesive application, external hanger design, expansion/contraction joint design and spacing and vapor retarder integrity.
3. Install insulation with all joints tightly butted (except expansion joints in hot applications).
4. If insulation thickness exceeds 63 mm (2.5 inches), install as a double layer system with longitudinal (lap) and butt joint staggering as recommended by manufacturer.
5. For cold applications, vapor retarder shall be installed in a continuous manner. No staples, rivets, screws or any other attachment device capable of penetrating the vapor retarder shall be used to attach the vapor retarder or jacketing. No wire ties capable of penetrating the vapor retarder shall be used to hold the insulation in place. Banding shall be used to attach PVC or metal jacketing.
6. Elbows, flanges and other fittings shall be insulated with the same material as is used on the pipe straights. The elbow/ fitting insulation shall be field-fabricated, mitered or factory prefabricated to the necessary size and shape to fit on the elbow/

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- fitting. Use of polyurethane spray-foam to fill PVC elbow jacket is prohibited on cold applications.
7. For cold applications, the vapor retarder on elbows/fittings shall be either mastic-fabric-mastic or 2 mil thick PVDC vapor retarder adhesive tape.
  8. All PVC and metal jacketing shall be installed so as to naturally shed water. Joints shall point down and shall be sealed with either adhesive or caulking (except for periodic slip joints).
  9. Note the NFPA 90A burning characteristic requirements of 25/50 in paragraph 1.3B. Refer to paragraph 3.1 for items not to be insulated.
  10. Minimum thickness in millimeter (inches) specified in the schedule at the end of this section.
- E. Flexible Elastomeric Cellular Thermal Insulation:
1. Apply insulation and fabricate fittings in accordance with the manufacturer's installation instructions and finish with two coats of weather resistant finish as recommended by the insulation manufacturer.
  2. Pipe and tubing insulation:
    - a. Use proper size material. Do not stretch or strain insulation.
    - b. To avoid undue compression of insulation, provide cork stoppers or wood inserts at supports as recommended by the insulation manufacturer. Insulation shields are specified under Section 22 05 11, COMMON WORK RESULTS FOR PLUMBING.
    - c. Where possible, slip insulation over the pipe or tubing prior to connection, and seal the butt joints with adhesive. Where the slip-on technique is not possible, slit the insulation and apply it to the pipe sealing the seam and joints with contact adhesive. Optional tape sealing, as recommended by the manufacturer, may be employed. Make changes from mineral fiber insulation in a straight run of pipe, not at a fitting. Seal joint with tape.
  3. Apply sheet insulation to flat or large curved surfaces with 100 percent adhesive coverage. For fittings and large pipe, apply adhesive to seams only.
  4. Pipe insulation: nominal thickness in millimeters (inches as specified in the schedule at the end of this section.

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**F. Calcium Silicate:**

1. Minimum thickness in millimeter (inches) specified below for piping.

<b>Nominal Thickness Of Calcium Silicate Insulation (Non-Boiler Plant)</b>				
<b>Nominal Pipe Size Millimeters (Inches)</b>	<b>Thru 25 (1)</b>	<b>32 to 75 (1-1/4 to 3)</b>	<b>100-200 (4 to 6)</b>	<b>Over 200 (6)</b>
93-260 degrees C(200- 500 degrees F)(HPS, HPR)	100(4)	125(5)	150(6)	150(6)

2. MRI Quench Vent Insulation: Type I, class D, 150 mm (6 inch) nominal thickness.

**3.3 PIPE INSULATION SCHEDULE**

Provide insulation for piping systems as scheduled below:

<b>Insulation Thickness Millimeters (Inches)</b>					
		<b>Nominal Pipe Size Millimeters (Inches)</b>			
<b>Operating Temperature Range/Service</b>	<b>Insulation Material</b>	<b>Less than 25 (1)</b>	<b>25 - 32 (1 - 1¼)</b>	<b>38 - 75 (1½ - 3)</b>	<b>100 (4) and Above</b>
38-60 degrees C (100-140 degrees F) (Domestic Hot Water Supply and Return)	Mineral Fiber (Above ground piping only)	38 (1.5)	38 (1.5)	50 (2.0)	50 (2.0)
38-60 degrees C (100-140 degrees F) (Domestic Hot Water Supply and Return)	Rigid Cellular Phenolic Foam (Above ground piping only)	38 (1.5)	38 (1.5)	50 (2.0)	50 (2.0)
38-60 degrees C (100-140 degrees F) (Domestic Hot Water Supply and Return)	Flexible Elastomeric Cellular Thermal (Above ground piping only)	38 (1.5)	38 (1.5)	----	----
4-16 degrees C (40-60 degrees F) (// Ice water piping //	Rigid Cellular Phenolic Foam (Above ground piping only)	25 (1.0)	25(1.0)	25 (1.0)	25 (1.0)

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(4-16 degrees C (40-60 degrees F) (// Ice water piping //))	Flexible Elastomeric Cellular Thermal (Above ground piping only)	25 (1.0)	25(1.0)	25 (1.0)	25 (1.0)
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SECTION 22 11 00

FACILITY WATER DISTRIBUTION

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Domestic water systems, including piping, equipment and all necessary accessories as designated in this section.

1.2 RELATED WORK

- A. Section 07 84 00, FIRESTOPPING.  
B. Section 09 91 00, PAINTING.  
C. Section 22 05 11, COMMON WORK RESULTS FOR PLUMBING.  
D. Section 23 07 11, HVAC, PLUMBING, AND BOILER PLANT INSULATION, PIPE INSULATION.

1.3 SUBMITTALS

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.  
B. Manufacturer's Literature and Data:  
1. All items listed in Part 2 - Products.

1.4 APPLICABLE PUBLICATIONS

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.  
B. American National Standards Institute (ANSI):  
American Society of Mechanical Engineers (ASME): (Copyrighted Society)  
A13.1 .....Scheme for Identification of Piping Systems  
B16.3-2011 .....Malleable Iron Threaded Fittings Classes 150  
and 300  
B16.15-2006 .....Cast Copper Alloy Threaded Fittings Classes 125  
and 250  
B16.18-2001 (R2005) ....Cast Copper Alloy Solder-Joint Pressure  
Fittings  
B16.22-2012 .....Wrought Copper and Copper Alloy Solder Joint  
Pressure Fittings  
B16.51-2011 .....Copper and Copper Alloy Press-Connect Fittings  
NSF/ANSI 61-2012 .....Drinking Water System Components - Health  
Effects

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C. American Society for Testing and Materials (ASTM):

A47/A47M-99(2009) .....Ferritic Malleable Iron Castings  
A53/A53M-12 .....Pipe, Steel, Black and Hot-Dipped, Zinc Coated  
Welded and Seamless  
A183-03(2009) .....Carbon Steel Track Bolts and Nuts  
A536-84(2009) .....Ductile Iron Castings  
B32-08 .....Solder Metal  
B61-08 .....Steam or Valve Bronze Castings  
B62-09 .....Composition Bronze or Ounce Metal Castings  
B75/B75M-11 .....Seamless Copper Tube  
B88-09 .....Seamless Copper Water Tube  
B584-12a .....Copper Alloy Sand Castings for General  
Applications  
B687-99(2011) .....Brass, Copper, and Chromium-Plated Pipe Nipples  
D2000-12 .....Rubber Products in Automotive Applications  
E1120-08 .....Liquid Chlorine  
E1229-08 .....Calcium Hypochlorite

D. International Plumbing Code

International Plumbing Code - 2009

E. American Society of Sanitary Engineers (ASSE):

ANSI/ASSE 1001-2008 ....Pipe Applied Atmospheric Type Vacuum Breakers  
ANSI/ASSE 1010-2004 ....Water Hammer Arresters  
ANSI/ASSE 1018-2001 ....Trap Seal Primer Valves - Potable Water  
Supplied  
ANSI/ASSE 1020-2004 ....Pressure Vacuum Breaker Assembly

F. Plumbing and Drainage Institute (PDI):

PDI WH-201 2010 .....Water Hammer Arrestor

**1.5 QUALITY ASSURANCE**

- A. All grooved joint couplings, fittings, valves, and specialties shall be the products of a single manufacturer. Grooving tools shall be by the same manufacturer as the groove components.
- B. All castings used for coupling housings, fittings, valve bodies, etc., shall be date stamped for quality assurance and traceability.

**1.6 SPARE PARTS**

- A. For mechanical press-connect fittings, provide tools required for each pipe size used at the facility.

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**PART 2 - PRODUCTS**

**2.1 ABOVE GROUND (INTERIOR) WATER PIPING**

- A. Pipe: Copper tube, ASTM B88, Type L, drawn. B. Fittings for Copper Tube:
  - 1. Wrought copper or bronze castings conforming to ANSI B16.18 and B16.22. Unions shall be bronze, MSS SP72 & SP 110, Solder or braze joints. Use 95/5 tin and antimony for all soldered joints.
  - 2. Mechanical press-connect fittings for copper pipe and tube shall conform to the material and sizing requirements of ASME B16.51, NSF/ANSI 61 approved, 2 inch (50 mm) size and smaller mechanical press-connect fittings, double pressed type, with EPDM (ethylene propylene diene monomer) non-toxic synthetic rubber sealing elements and un-pressed fitting identification feature.
- B. Adapters: Provide adapters for joining screwed pipe to copper tubing.
- C. Solder: ASTM B32 Composition Sb5 HA or HB. Provide non-corrosive flux.
- D. Brazing alloy: AWS A5.8, Classification BCuP.

**2.2 EXPOSED WATER PIPING**

- A. Finished Room: Use full iron pipe size chrome plated brass piping for exposed water piping connecting fixtures, casework, cabinets, equipment and reagent racks when not concealed by apron including those furnished by the Government or specified in other sections.
  - 1. Pipe: Fed. Spec. WW-P-351, standard weight.
  - 2. Fittings: ANSI B16.15 cast bronze threaded fittings with chrome finish.
  - 3. Nipples: ASTM B 687, Chromium-plated.
  - 4. Unions: MSS SP-72, SP-110, Brass or Bronze with chrome finish.  
Unions 2-1/2 inches (65 mm) and larger shall be flange type with approved gaskets.
- B. Unfinished Rooms and Mechanical Rooms: Chrome-plated brass piping is not required. Paint piping systems as specified in Section 09 91 00, PAINTING.

**2.3 TRAP PRIMER WATER PIPING:**

- A. Pipe: Copper tube, ASTM B88, type K, hard drawn.
- B. Fittings: Bronze castings conforming to ANSI B16.18 Solder joints.
- C. Solder: ASTM B32 composition Sb5. Provide non-corrosive flux.

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**2.4 DIELECTRIC FITTINGS**

- A. Provide dielectric couplings or unions between ferrous and non-ferrous pipe.

**2.5 STERILIZATION CHEMICALS**

- A. Hypochlorite: ASTM E1120-08
- B. Liquid Chlorine: ASTM E1229-08

**2.6 WATER HAMMER ARRESTER:**

- A. Closed copper tube chamber with permanently sealed 60 psig (410 KpA) air charge above a Double O-ring piston. Two high heat Buna-N O-rings pressure packed and lubricated with FDA approved silicone compound. All units shall be designed in accordance with ASSE 1010 for sealed wall installations without an access panel. Size and install in accordance with Plumbing and Drainage Institute requirements (PDI-WH 201). Provide water hammer arrestors at:
  - 1. All solenoid valves.
  - 2. All groups of two or more flush valves.
  - 3. All quick opening or closing valves.

**PART 3 - EXECUTION**

**3.1 INSTALLATION**

- A. General: Comply with the International Plumbing Code and the following:
  - 1. Install branch piping for water from the piping system and connect to all fixtures, valves, cocks, outlets, casework, cabinets and equipment, including those furnished by the Government or specified in other sections.
  - 2. Pipe shall be round and straight. Cutting shall be done with proper tools. Pipe, except for plastic and glass, shall be reamed to full size after cutting.
  - 3. All pipe runs shall be laid out to avoid interference with other work.
  - 4. Install union and shut-off valve on pressure piping at connections to equipment.
  - 5. Pipe Hangers, Supports and Accessories:
    - a. All piping shall be supported per the International Plumbing Code.
    - b. Shop Painting and Plating: Hangers, supports, rods, inserts and accessories used for pipe supports shall be shop coated with red

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lead or zinc chromate primer paint. Electroplated copper hanger rods, hangers and accessories may be used with copper tubing.

c. Floor, Wall and Ceiling Plates, Supports, Hangers:

- 1) Solid or split un-plated cast iron.
  - 2) All plates shall be provided with set screws.
  - 3) Pipe Hangers: Height adjustable clevis type.
  - 4) Adjustable Floor Rests and Base Flanges: Steel.
  - 5) Concrete Inserts: "Universal" or continuous slotted type.
  - 6) Hanger Rods: Mild, low carbon steel, fully threaded or Threaded at each end with two removable nuts at each end for positioning rod and hanger and locking each in place.
  - 7) Riser Clamps: Malleable iron or steel.
  - 8) Rollers: Cast iron.
  - 9) Self-drilling type expansion shields shall be "Phillips" type, with case hardened steel expander plugs.
  - 10) Hangers and supports utilized with insulated pipe and tubing shall have 180 degree (min.) metal protection shield Centered on and welded to the hanger and support. The shield shall be 4 inches in length and be 16 gauge steel. The shield shall be sized for the insulation.
  - 11) Miscellaneous Materials: As specified, required, directed or as noted on the drawings for proper installation of hangers, supports and accessories. If the vertical distance exceeds 6 m (20 feet) for cast iron pipe additional support shall be provided in the center of that span. Provide all necessary auxiliary steel to provide that support.
6. Install chrome plated cast brass escutcheon with set screw at each wall, floor and ceiling penetration in exposed finished locations and within cabinets and millwork.
7. Penetrations:
- a. Fire Stopping: Where pipes pass through fire partitions, fire walls, smoke partitions, or floors, install a fire stop that provides an effective barrier against the spread of fire, smoke and gases as specified in Section 07 84 00. Completely fill and seal clearances between raceways and openings with the fire stopping materials.

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- b. Waterproofing: At floor penetrations, completely seal clearances around the pipe and make watertight with sealant as specified in Section 07 92 00.
- 8. Mechanical press-connect fitting connections shall be made in accordance with the manufacturer's installation instructions. Depth of insertion must be marked on the tube prior to inserting the tube into the fitting. Ensure the tube is completely inserted to the fitting stop (appropriate depth) and squared with the fitting prior to applying the pressing jaws onto the fitting. The joints shall be pressed using the tool(s) approved by the manufacturer. Minimum distance between fittings shall be in accordance with the manufacturer's requirements. When the pressing cycle is complete, visually inspect the joint to ensure the tube has remained fully inserted, as evidenced by the visible insertion mark.
- B. Piping shall conform to the following:
  - 1. Domestic Water:
    - a. Grade all lines to facilitate drainage. Provide drain valves at bottom of risers and all low points in system. Design domestic hot water circulating lines with no traps.
    - b. Connect branch lines at bottom of main serving fixtures below and pitch down so that main may be drained through fixture. Connect branch lines to top of main serving only fixtures located on floor above.

**3.2 TESTS**

- A. General: Test system either in its entirety or in sections. Submit testing plan to Resident Engineer/COR 14 days prior to test date.
- B. Potable Water System: Test after installation of piping and domestic water heaters, but before piping is concealed, before covering is applied, and before plumbing fixtures are connected. Fill systems with water and maintain hydrostatic pressure of 150 psi (1040 kPa) gage for two hours. No decrease in pressure is allowed. Provide a pressure gage with a shutoff and bleeder valve at the highest point of the piping being tested.

**3.3 STERILIZATION**

- A. After tests have been successfully completed, thoroughly flush and sterilize the interior domestic water distribution system in accordance with AWWA C651.

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B. Use liquid chlorine or hypochlorite for sterilization.

**3.4 COMMISSIONING**

- A. Provide commissioning documentation accordance with the requirements of Section 22 08 00.
- B. Components provided under this section of the specification will be tested as part of a larger system.

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SECTION 22 13 00  
FACILITY SANITARY AND VENT PIPING

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

This section pertains to sanitary sewer and vent systems, including piping, equipment and all necessary accessories as designated in this section.

**1.2 RELATED WORK**

- A. Section 07 84 00, FIRESTOPPING: Penetrations in rated enclosures.
- B. Section 09 91 00, PAINTING: Preparation and finish painting and identification of piping systems.
- C. Section 22 05 11, COMMON WORK RESULTS FOR PLUMBING: Pipe Hangers and Supports, Materials Identification.
- D. Section 23 07 11, HVAC, PLUMBING, AND BOILER PLANT INSULATION: Pipe Insulation.
- E. Section 07 92 00 Joint Sealants: Sealant products.

**1.3 SUBMITTALS**

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, and SAMPLES.
- B. Manufacturer's Literature and Data:
  - 1. Piping.
  - 2. Floor Drains.
  - 3. Cleanouts.
  - 4. All items listed in Part 2 - Products.
- C. Detailed shop drawing of clamping device and extensions when required in connection with the waterproofing membrane or the floor drain.

**1.4 APPLICABLE PUBLICATIONS**

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.
- B. American Society of Mechanical Engineers (ASME): (Copyrighted Society)
  - A112.6.3-01 (R 2007) ...Standard for Floor and Trench Drains
  - A13.1-07 .....Scheme for Identification of Piping Systems
  - B16.3-06 .....Malleable Iron Threaded Fittings, Classes 150 and 300
  - B16.4-06 .....Standard for Grey Iron Threaded Fittings  
Classes 125 and 250

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B16.12-98 (R 2006) .....Cast Iron Threaded Drainage Fittings  
B16.15-06 .....Cast Bronze Threaded Fittings, Classes 125 and  
250

C. American Society for Testing and Materials (ASTM):

A47/A47M-99 (R 2004) ...Standard Specification for Steel Sheet,  
Aluminum Coated, by the Hot Dip Process  
A53/A53M-07 .....Standard Specification for Pipe, Steel, Black  
And Hot-Dipped, Zinc-coated, Welded and  
Seamless  
A74-06 .....Standard Specification for Cast Iron Soil Pipe  
and Fittings  
A183-03 .....Standard Specification for Carbon Steel Track  
Bolts and Nuts  
A536-84(R 2004) .....Standard Specification for Ductile Iron  
Castings  
B32-08 .....Standard Specification for Solder Metal  
B75-02 .....Standard Specification for Seamless Copper Tube  
B306-02 .....*Standard Specification for Copper Drainage Tube*  
(DWV)  
B584-06a .....Standard Specification for Copper Alloy Sand  
Castings for General Applications  
C564-03a .....Standard Specification for Rubber Gaskets for  
Cast Iron Soil Pipe and Fittings  
D2000-08 .....Standard Classification System for Rubber  
Products in Automotive Applications  
D2564-04E1 .....Standard Specification for Solvent Cements for  
Poly (Vinyl Chloride) (PVC) Plastic Pipe and  
Fittings  
D2665-08 .....*Standard Specification for Poly (Vinyl*  
*Chloride) (PVC) Plastic Drain, Waste, and Vent*  
*Pipe and Fittings*

D. International Code Council:

IPC-06 .....International Plumbing Code

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E. Cast Iron Soil Pipe Institute (CISPI):

301-05 .....Hubless Cast Iron Soil Pipe and Fittings for  
Sanitary and Storm Drain, Waste, and Vent  
Piping Applications

310-04 .....Coupling for Use in Connection with Hubless  
Cast Iron Soil Pipe and Fittings for Sanitary  
and Storm Drain, Waste, and Vent Piping  
Applications

F. American Society of Sanitary Engineers (ASSE):

1018-01 .....Trap Seal Primer Valves - Potable, Water  
Supplied

G. Plumbing and Drainage Institute (PDI):

PDI WH-201 .....Water Hammer Arrestor

**PART 2 - PRODUCTS**

**2.1 SANITARY WASTE, DRAIN, AND VENT PIPING**

A. Cast iron waste, drain, and vent pipe and fittings:

1. Cast iron waste, drain, and vent pipe and fittings shall be used for the following applications:
  - a. pipe buried in or in contact with earth
  - b. sanitary pipe extensions to a distance of approximately 1500 mm (5 feet) outside of the building.
  - c. interior waste and vent piping above grade.
2. Cast iron Pipe shall be bell and spigot or hubless (plain end or no-hub or hubless).
3. The material for all pipe and fittings shall be cast iron soil pipe and fittings and shall conform to the requirements of CISPI Standard 301, ASTM A-888, or ASTM A-74.
4. Joints for hubless pipe and fittings shall conform to the manufacturer's installation instructions. Couplings for hubless joints shall conform to CISPI 310. Joints for hub and spigot pipe shall be installed with compression gaskets conforming to the requirements of ASTM Standard C-564 or be installed with lead and oakum.

B. Copper Tube, (DWV):

1. Copper DWV tube sanitary waste, drain and vent pipe may be used for piping above ground, except for urinal drains.

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2. The copper DWV tube shall be drainage type, drawn temper conforming to ASTM B306.
3. The copper drainage fittings shall be cast copper or wrought copper conforming to ASME B16.23 or ASME 16.29.
4. The joints shall be lead free, using a water flushable flux, and conforming to ASTM B32.

**2.2 EXPOSED WASTE PIPING**

- A. Full iron pipe size chrome plated brass piping shall be used in finished rooms for exposed waste piping connecting fixtures, casework, cabinets and equipment when not concealed by apron including those furnished by the Government or specified in other sections.
  1. The Pipe shall meet Fed. Spec. WW-P-351, standard weight.
  2. The Fittings shall conform to ANSI B16.15, cast bronze threaded fittings with chrome finish, (125 and 250).
  3. Nipples shall conform to ASTM B 687, Chromium-plated.
  4. Unions shall be brass or bronze with chrome finish. Unions 65 mm (2-1/2 inches) and larger shall be flange type with approved gaskets.
- B. In unfinished Rooms such as mechanical Rooms, Chrome-plated brass piping is not required. The pipe materials specified under the paragraph "Sanitary Waste, Drain, and Vent Piping" can be used. The sanitary pipe in unfinished rooms shall be painted as specified in Section 09 91 00, PAINTING.

**2.3 SPECIALTY PIPE FITTINGS**

- A. Transition pipe couplings shall join piping with small differences in outside diameters or different materials. End connections shall be of the same size and compatible with the pipes being joined. The transition coupling shall be elastomeric, sleeve type reducing or transition pattern and include shear and corrosion resistant metal, tension band and tightening mechanism on each end. The transition coupling sleeve coupling shall be of the following material:
  1. For cast iron soil pipes, the sleeve material shall be rubber conforming to ASTM C564.
  2. For dissimilar pipes, the sleeve material shall be PVC conforming to ASTM D5926, or other material compatible with the pipe materials being joined.

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- B. The dielectric fittings shall conform to ASSE 1079 with a pressure rating of 860 kPa (125 psig) at a minimum temperature of 82°C (180°F). The end connection shall be solder joint copper alloy and threaded ferrous.
- C. Dielectric flange insulating kits shall be of non-conducting materials for field assembly of companion flanges with a pressure rating of 1035 kPa (150 psig). The gasket shall be neoprene or phenolic. The bolt sleeves shall be phenolic or polyethylene. The washers shall be phenolic with steel backing washers.
- D. The di-electric nipples shall be electroplated steel nipple complying with ASTM F 1545 with a pressure ratings of 2070 kPa (300 psig) at 107°C (225°F). The end connection shall be male threaded. The lining shall be inert and noncorrosive propylene.

**2.4 CLEANOUTS**

- A. Cleanouts shall be the same size as the pipe, up to 100 mm (4 inches); and not less than 100 mm (4 inches) for larger pipe. Cleanouts shall be easily accessible and shall be gastight and watertight. Minimum clearance of 600 mm (24 inches) shall be provided for clearing a clogged sanitary line.
- B. Floor cleanouts shall be gray iron housing with clamping device and round, secured, scoriated, gray iron cover conforming to ASME A112.36.2M. A gray iron ferrule with hubless, socket, inside calk or spigot connection and counter sunk, taper-thread, brass or bronze closure plug shall be included. The frame and cover material and finish shall be nickel-bronze copper alloy with a square shape. The cleanout shall be vertically adjustable for a minimum of 50 mm (2 inches). When a waterproof membrane is used in the floor system, clamping collars shall be provided on the cleanouts. Cleanouts shall consist of wye fittings and eighth bends with brass or bronze screw plugs. Cleanouts in the resilient tile floors, quarry tile and ceramic tile floors shall be provided with square top covers recessed for tile insertion. In the carpeted areas, carpet cleanout markers shall be provided. Two way cleanouts shall be provided where indicated on drawings and at every building exit. The loading classification for cleanouts in sidewalk areas or subject to vehicular traffic shall be heavy duty type.

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- C. Cleanouts shall be provided at or near the base of the vertical stacks with the cleanout plug located approximately 600 mm (24 inches) above the floor. If there are no fixtures installed on the lowest floor, the cleanout shall be installed at the base of the stack. The cleanouts shall be extended to the wall access cover. Cleanout shall consist of sanitary tees. Nickel-bronze square frame and stainless steel cover with minimum opening of 150 by 150 mm (6 by 6 inches) shall be furnished at each wall cleanout. Where the piping is concealed, a fixture trap or a fixture with integral trap, readily removable without disturbing concealed pipe, shall be accepted as a cleanout equivalent providing the opening to be used as a cleanout opening is the size required.
- D. In horizontal runs above grade, cleanouts shall consist of cast brass tapered screw plug in fitting or caulked/hubless cast iron ferrule. Plain end (hubless) piping in interstitial space or above ceiling may use plain end (hubless) blind plug and clamp.

**2.5 FLOOR DRAINS**

- A. Type B (FD-B) floor drain shall comply with ANSI A112.6.3. The type B floor drain shall be constructed of galvanized cast iron with medium duty nickel bronze grate, double drainage pattern, clamping device, without sediment bucket but with secondary strainer in bottom. The grate shall be 175 mm (7 inches) minimum.
- B. Type C (FD-C) floor drain shall comply with ANSI A112.6.3. The type C floor drain shall have a cast iron body, double drainage pattern, clamping device, light duty square or round nickel bronze adjustable strainer and grate with vandal proof screws. The grate shall be square, 150 mm (6 inches) minimum.

**2.6 TRAPS**

- A. Traps shall be provided on all sanitary branch waste connections from fixtures or equipment not provided with traps. Exposed brass shall be polished brass chromium plated with nipple and set screw escutcheons. Concealed traps may be rough cast brass or same material as pipe connected to. Slip joints are not permitted on sewer side of trap. Traps shall correspond to fittings on cast iron soil pipe or steel pipe respectively, and size shall be as required by connected service or fixture.

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**2.7 TRAP SEAL PRIMER VALVES AND TRAP SEAL PRIMER SYSTEMS**

- A. Trap Primer (TP-2): The trap seal primer valve shall be hydraulic, supply type with a pressure rating of 5.98 kPa (125 psig) and conforming to standard ASSE 1018.
  - 1. The inlet and outlet connections shall be 15 mm or DN15 (NPS ½ inch)
  - 2. The trap seal primer valve shall be fully automatic with an all brass or bronze body.
  - 3. The trap seal primer valve shall be activated by a drop in building water pressure, no adjustment required.
  - 4. The trap seal primer valve shall include a manifold when serving two, three, or four traps.
  - 5. The manifold shall be omitted when serving only one trap.

**2.8 WATERPROOFING**

- A. A sleeve flashing device shall be provided at points where pipes pass through membrane waterproofed floors or walls. The sleeve flashing device shall be manufactured, cast iron fitting with clamping device that forms a sleeve for the pipe floor penetration of the floor membrane. A galvanized steel pipe extension shall be included in the top of the fitting that will extend 50 mm (2 inches) above finished floor and galvanized steel pipe extension in the bottom of the fitting that will extend through the floor slab. A waterproof caulked joint shall be provided at the top hub.
- B. Walls: See detail shown on drawings.

**PART 3 - EXECUTION**

**3.1 PIPE INSTALLATION**

- A. The pipe installation shall comply with the requirements of the International Plumbing Code (IPC) and these specifications.
- B. Branch piping shall be installed for waste from the respective piping systems and connect to all fixtures, valves, cocks, outlets, casework, cabinets and equipment, including those furnished by the Government or specified in other sections.
- C. Pipe shall be round and straight. Cutting shall be done with proper tools. Pipe shall be reamed to full size after cutting.
- D. All pipe runs shall be laid out to avoid interference with other work.
- E. The piping shall be installed above accessible ceilings where possible.
- F. The piping shall be installed to permit valve servicing or operation.

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- G. Unless specifically indicated on the drawings, the minimum slope shall be 2% slope.
- H. The piping shall be installed free of sags and bends.
- I. Seismic restraint shall be installed where required by code.
- J. Changes in direction for soil and waste drainage and vent piping shall be made using appropriate branches, bends and long sweep bends.  
Sanitary tees and short sweep quarter bends may be used on vertical stacks if change in direction of flow is from horizontal to vertical. Long turn double wye branch and eighth bend fittings shall be used if two fixtures are installed back to back or side by side with common drain pipe. Straight tees, elbows, and crosses may be used on vent lines. Do not change direction of flow more than 90 degrees. Proper size of standard increaser and reducers shall be used if pipes of different sizes are connected. Reducing size of drainage piping in direction of flow is prohibited.
- K. Cast iron piping shall be installed according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook," Chapter IV, "Installation of Cast Iron Soil Pipe and Fittings"
- L. Aboveground copper tubing shall be installed according to CDA's "Copper Tube Handbook".

**3.2 JOINT CONSTRUCTION**

- A. Hub and spigot, cast iron piping with gasket joints shall be joined in accordance with CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for compression joints.
- B. Hub and spigot, cast iron piping with calked joints shall be joined in accordance with CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for lead and oakum calked joints.
- C. Hubless or No-hub, cast iron piping shall be joined in accordance with CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for hubless piping coupling joints.
- D. For threaded joints, thread pipe with tapered pipe threads according to ASME B1.20.1. The threads shall be cut full and clean using sharp disc cutters. Threaded pipe ends shall be reamed to remove burrs and restored to full pipe inside diameter. Pipe fittings and valves shall be joined as follows:
  - 1. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is required by the pipe service



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2. Pipe sections with damaged threads shall be replaced with new sections of pipe.

E. Copper tube and fittings with soldered joints shall be joined according to ASTM B828. A water flushable, lead free flux conforming to ASTM B813 and a lead free alloy solder conforming to ASTM B32 shall be used.

**3.3 SPECIALTY PIPE FITTINGS**

A. Transition coupling shall be installed at pipe joints with small differences in pipe outside diameters.

B. Dielectric fittings shall be installed at connections of dissimilar metal piping and tubing.

**3.4 PIPE HANGERS, SUPPORTS AND ACCESSORIES:**

A. All piping shall be supported according to the International Plumbing Code (IPC), Section 22 05 11, COMMON WORK RESULTS FOR PLUMBING, and these specifications. Where conflicts arise between these the code and Section 22 05 11, the most restrictive or the requirement that specifies supports with highest loading or shortest spacing shall apply.

B. Hangers, supports, rods, inserts and accessories used for pipe supports shall be shop coated with zinc chromate primer paint. Electroplated copper hanger rods, hangers and accessories may be used with copper tubing.

C. Horizontal piping and tubing shall be supported within 300 mm (12 inches) of each fitting or coupling.

D. Horizontal cast iron piping shall be supported with the following maximum horizontal spacing and minimum hanger rod diameters:

1. 40 mm or DN40 to 50 mm or DN50 (NPS 1-1/2 inch to NPS 2 inch): 1500 mm (60 inches) with 10 mm (3/8 inch) rod.

2. 80 mm or DN 80 (NPS 3 inch): 1500 mm (60 inches) with 13 mm (1/2 inch) rod.

3. 100 mm or DN100 to 125 mm or DN125 (NPS 4 to NPS 5): 1500 mm (60 inches) with 16 mm (5/8 inch) rod.

4. 150 mm or DN150 to 200 mm or DN200 (NPS 6 inch to NPS 8 inch): 1500 mm (60 inches) with 19 mm (3/4 inch) rod.

5. 250 mm or DN250 to 300 mm or DN 300 (NPS 10 inch to NPS 12 inch): 1500 mm (60 inch) with 22 mm (7/8 inch) rod.

E. The maximum spacing for plastic pipe shall be 1.22 m (4 feet).

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- F. Vertical piping and tubing shall be supported at the base, at each floor, and at intervals no greater than 4.57 m (15 feet).
- G. In addition to the requirements in Section 22 05 11, COMMON WORK RESULTS FOR PLUMBING, floor, Wall and Ceiling Plates, Supports, Hangers shall have the following characteristics:
  - 1. Solid or split unplated cast iron.
  - 2. All plates shall be provided with set screws.
  - 3. Height adjustable clevis type pipe hangers.
  - 4. Adjustable floor rests and base flanges shall be steel.
  - 5. Hanger rods shall be low carbon steel, fully threaded or threaded at each end with two removable nuts at each end for positioning rod and hanger and locking each in place.
  - 7. Riser clamps shall be malleable iron or steel.
  - 8. Rollers shall be cast iron.
  - 9. See Section 22 05 11, COMMON WORK RESULTS FOR PLUMBING, for requirements on insulated pipe protective shields at hanger supports.
- H. Miscellaneous materials shall be provided as specified, required, directed or as noted on the drawings for proper installation of hangers, supports and accessories. If the vertical distance exceeds 6 m (20 feet) for cast iron pipe additional support shall be provided in the center of that span. All necessary auxiliary steel shall be provided to provide that support.
- I. Cast escutcheon with set screw shall be provided at each wall, floor and ceiling penetration in exposed finished locations and within cabinets and millwork.
- J. Penetrations:
  - 1. Fire Stopping: Where pipes pass through fire partitions, fire walls, smoke partitions, or floors, a fire stop shall be installed that provides an effective barrier against the spread of fire, smoke and gases as specified in Section 07 84 00, FIRESTOPPING. Clearances between raceways and openings shall be completely filled and sealed with the fire stopping materials.
  - 2. Water proofing: At floor penetrations, clearances shall be completely sealed around the pipe and make watertight with sealant as specified in Section 07 92 00, JOINT SEALANTS.

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K. Piping shall conform to the following:

1. Waste and Vent Drain to main stacks:

Pipe Size	Minimum Pitch
80 mm or DN 80 (3 inches) and smaller	2%
100 mm or DN 100 (4 inches) and larger	1%

2. Exhaust vents shall be extended separately through roof. Sanitary vents shall not connect to exhaust vents.

**3.5 TESTS**

A. Sanitary waste and drain systems shall be tested either in its entirety or in sections.

B. Waste System tests shall be conducted before trenches are backfilled or fixtures are connected. A water test or air test shall be conducted, as directed.

1. If entire system is tested for a water test, tightly close all openings in pipes except highest opening, and fill system with water to point of overflow. If the waste system is tested in sections, tightly plug each opening except highest opening of section under test, fill each section with water and test with at least a 3 m (10 foot) head of water. In testing successive sections, test at least upper 3 m (10 feet) of next preceding section so that each joint or pipe except upper most 3 m (10 feet) of system has been submitted to a test of at least a 3 m (10 foot) head of water. Water shall be kept in the system, or in portion under test, for at least 15 minutes before inspection starts. System shall then be tight at all joints.

2. For an air test, an air pressure of 35 kPa (5 psig) gage shall be maintained for at least 15 minutes without leakage. A force pump and mercury column gage shall be used for the air test.

3. After installing all fixtures and equipment, open water supply so that all p-traps can be observed. For 15 minutes of operation, all p-traps shall be inspected for leaks and any leaks found shall be corrected.

3. Final Tests: Either one of the following tests may be used.

a. Smoke Test: After fixtures are permanently connected and traps are filled with water, fill entire drainage and vent systems with

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smoke under pressure of 1.3 kPa (1 inch of water) with a smoke machine. Chemical smoke is prohibited.

- b. Peppermint Test: Introduce (2 ounces) of peppermint into each line or stack.

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**SECTION 22 40 00**  
**PLUMBING FIXTURES**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

Plumbing fixtures, associated trim and fittings necessary to make a complete installation from wall or floor connections to rough piping, and certain accessories.

**1.2 RELATED WORK**

- A. Sealing between fixtures and other finish surfaces: Section 07 92 00, JOINT SEALANTS.
- B. Flush panel access doors: Section 08 31 13, ACCESS DOORS AND FRAMES.
- C. Through bolts: Section 10 21 13, TOILET COMPARTMENTS.
- D. Section 22 05 11, COMMON WORK RESULTS FOR PLUMBING.

**1.3 SUBMITTALS**

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Submit plumbing fixture information in an assembled brochure, showing cuts and full detailed description of each fixture.

**1.4 APPLICABLE PUBLICATIONS**

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.
- B. American National Standard Institute (ANSI):  
The American Society of Mechanical Engineers (ASME):  
A112.6.1M-02(R2008) ....Floor Affixed Supports for Off-the-Floor  
Plumbing Fixtures for Public Use  
A112.19.1M-08 .....Enameled Cast Iron Plumbing Fixtures  
A112.19.2M-03 .....Vitreous China Plumbing Fixtures  
A112.19.3-2001(R2008) ..Stainless Steel Plumbing Fixtures (Designed for  
Residential Use)
- C. American Society for Testing and Materials (ASTM):  
A276-2010 .....Stainless and Heat-Resisting Steel Bars and  
Shapes  
WW-P-541-E/GEN .....Plumbing Fixtures with Amendment 1
- D. National Association of Architectural Metal Manufacturers (NAAMM): NAAMM  
AMP 500-505  
Metal Finishes Manual (1988)

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- E. American Society of Sanitary Engineers (ASSE):  
1016-05 .....Performance Requirements for Individual  
Thermostatic, Pressure Balancing and Combination  
Pressure Balancing and Thermostatic Control  
Valves for Individual Fixture Fittings
- F. National Sanitation Foundation (NSF)/American National Standards  
Institute (ANSI):  
61-2009 .....Drinking Water System Components-Health Effects
- G. American with Disabilities Act (A.D.A) Section 4-19.4 Exposed Pipes and  
Surfaces
- H. Environmental Protection Agency EPA PL 93-523 1974; A 1999) Safe  
Drinking Water Act.
- I. International Building Code, ICC IPBC 2009.

**PART 2 - PRODUCTS**

**2.1 STAINLESS STEEL**

- A. Corrosion-resistant Steel (CRS):
  - 1. Plate, Sheet and Strip: CRS flat products shall conform to chemical composition requirements of any 300 series steel specified in ASTM A276.
  - 2. Finish: Exposed surfaces shall have standard polish (ground and polished) equal to NAAMM finish Number 4.
- B. Die-cast zinc alloy products are prohibited.

**2.2 STOPS**

- A. Provide lock-shield loose key or screw driver pattern angle stops, straight stops or stops integral with faucet, with each compression type faucet whether specifically called for or not, including sinks in wood and metal casework, laboratory furniture and pharmacy furniture. Locate stops centrally above or below fixture in accessible location.
- B. Furnish keys for lock shield stops to Resident Engineer.
- C. Supply from stops not integral with faucet shall be chrome plated copper flexible tubing or flexible stainless steel with inner core of non-toxic polymer.
- D. Supply pipe from wall to valve stop shall be rigid threaded IPS copper alloy pipe, i.e. red brass pipe nipple, chrome plated where exposed.

**2.3 ESCUTCHEONS**

Heavy type, chrome plated, with set screws. Provide for piping serving plumbing fixtures and at each wall, ceiling and floor penetrations in exposed finished locations and within cabinets and millwork.

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**2.4 LAMINAR FLOW CONTROL DEVICE**

- A. Smooth, bright stainless steel or satin finish, chrome plated metal laminar flow device shall provide non-aeration, clear, coherent laminar flow that will not splash in basin. Device shall also have a flow control restrictor and have vandal resistant housing.
- B. Flow Control Restrictor:
  - 1. Capable of restricting flow from 95 ml/s to 110 ml/s (1.5 gpm to 1.7 gpm) for lavatories; and 125 ml/s to 140 ml/s (2.0 gpm to 2.2 gpm) for sinks P-505 through P-520, P-524 and P-528.
  - 2. Compensates for pressure fluctuation maintaining flow rate specified above within 10 percent between 170 kPa and 550 kPa (25 psi and 80 psi).
  - 3. Operates by expansion and contraction, eliminates mineral/sediment build-up with self-cleaning action, and is capable of easy manual cleaning.

**2.5 CARRIERS**

- A. ASME/ANSI A112.6.1M, with adjustable gasket faceplate chair carriers for wall hung closets with auxiliary anchor foot assembly, hanger rod support feet, and rear anchor tie down.
- B. ASME/ANSI A112.6.1M, lavatory, chair carrier for thin wall construction. All lavatory chair carriers shall be capable of supporting the lavatory with a 250-pound vertical load applied at the front of the fixture.
- C. Where water closets, lavatories or sinks are installed back-to-back and carriers are specified, provide one carrier to serve both fixtures in lieu of individual carriers. The drainage fitting of the back to back carrier shall be so constructed that it prevents the discharge from one fixture from flowing into the opposite fixture.

**2.6 WATER CLOSETS**

- A. (P-101) Water Closet (Floor Mounted, ANSI 112.19.2M, Figure 6) - office and industrial, elongated bowl, siphon jet 6 L (1.6 gallons) per flush, floor outlet. Top of rim shall be 435 mm to 438 mm (17 1/8 inches to 17 1/4 inches) above finished floor.
  - 1. Seat: Institutional/Industrial, extra heavy duty, chemical resistant, solid plastic, open front less cover for elongated bowls, integrally molded bumpers, concealed check hinge with stainless steel post. Seat shall be posture contoured body design. Color shall be white.
  - 2. Fittings and Accessories: Floor flange fittings-cast iron; Gasket-wax; bolts with chromium plated cap nuts and washers.
  - 3. Flush valve: Large chloramines resistant diaphragm, semi-red brass valve body, exposed chrome plated, non-hold-open ADA approved side

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oscillating handle, water saver design 6 L (1.6 gallons) per flush with maximum 10 percent variance, top spud connection, adjustable tailpiece, one-inch IPS screwdriver back check angle stop with vandal resistant cap, high back pressure vacuum breaker, and sweat solder adapter with cover tube and cast set screw wall flange. Set centerline of inlet 292 mm (11 1/2 inches) above rim. Seat bumpers shall be integral part of flush valve. Valve body, cover, tailpiece and control stop shall be in conformance with ASTM Alloy classification for semi-red brass.

- B. (P-102) Water Closet (Floor Mounted With Bedpan Washer ASME/ANSI A112.19.2M, Figure 6) wall outlet, with bed pan lugs - bedpan washer, flush valve operated, 6 L (1.6 gallons) per flush. Top of rim shall be 457 mm (18 inches) above finished floor. Provide standoff bracket support between studs for bedpan washer at height as recommended by manufacturer.
1. Seat: Institutional/Industrial, extra heavy duty, chemical resistant, solid plastic, open front less cover for elongated bowls, integrally molded bumpers, concealed check hinge with stainless steel post. Seat shall be posture contoured body design. Color shall be white.
  2. Fittings and Accessories: Floor Flange fittings - cast iron; gaskets - wax; bolts with chromium plated cap nuts and washers.
  3. Flush valve: Large chloramines resistant diaphragm, semi-red brass valve body, exposed chrome plated, non-hold-open, ADA approved side oscillating handle, offset top spud connection, adjustable tailpiece, one-inch IPS screwdriver back check angle stop with vandal resistant cap, sweat solder adapter with cover tube and cast set screw wall flange, and high back pressure vacuum breaker. Valve body, cover, tailpiece and control stop shall be in conformance with ASTM Alloy classification for semi-red brass. Set centerline of inlet 673 mm (26 1/2 inches) above rim. Seat bumpers shall be set in wall behind fixture at proper contact height.

**2.7 URINALS**

- A. (P-202) Urinal (Wheelchair, Wall Hung, ANSI A112.19.2M, Figure 30) bowl with integral flush distribution, wall to front of flare 356 mm (14 inches). Wall hung with integral trap, siphon jet flushing action 4 L (1.0 gallon per flush) with 51 mm (2 inches) back outlet and 19 mm (3/4 inch) top inlet spud.
1. Support urinal with chair carrier and install with rim 381 mm (15 inches) above finished floor.



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2. Flushing Device: Large chloramines resistant diaphragm, semi-red brass body, exposed flush valve, non-hold-open, water saver design, 19 mm (3/4 inch) capped screwdriver angle stop valve. Set centerline of inlet 292 mm (11 1/2 inches) above urinal. Valve body, cover, tailpiece and control stop shall be in conformance with ASTM alloy classification for semi-red brass.

**2.8 LAVATORIES**

- A. Dimensions for lavatories are specified, Length by width (distance from wall) and depth.
- B. Brass components in contact with water shall contain no more than 3 percent lead content by dry weight.
- C. (P-402) Lavatory (Elbow Control, ASME/ANSI A112.19.2M, Figure 16) straight back, approximately 508 mm by 457 mm (20 inches by 18 inches) and a 102 mm (4 inches) maximum apron, first quality vitreous china. Punching for faucet on 203 mm (8 inches) centers. Set with rim 864 mm (34 inches) above finished floor.
  1. Faucet: Solid cast brass construction with washerless ceramic disc mixing cartridge type and centrally exposed rigid gooseneck spout with outlet 127-152 mm (5-6 inches) above rim. Provide laminar flow control device. One hundred millimeters (4 inches) elbow handles on faucets shall be cast, formed or drop forged copper alloy. Faucet, wall and floor escutcheons shall be either copper alloy or CRS. Exposed metal parts, including exposed part under valve handle when in open position, shall have a smooth bright finish.
  2. Drain: Cast or wrought brass with flat grid strainer and offset tailpiece, chrome plated finish.
  3. Stops: Angle type, See paragraph 2.2. Stops
  4. Trap: Cast copper alloy, 38 mm by 32 mm (1 1/2 inches by 1 1/4 inches) P-trap. Adjustable with connected elbow and 1.4 mm thick (17 gauge) tubing extensions to wall. Exposed metal trap surfaces and connection hardware shall be chrome plated with a smooth bright finish. Set trap parallel to wall.
  5. Provide cover for drain, stops and trap per A.D.A 4-19.4.
- D. (P-413) Lavatory (Counter Mounted Stainless Steel, Undermount) approximately 483 mm (19 inches) in diameter with punching for faucet on 203 mm (8 inches) centers. Mount unit in countertop.
  1. Faucet: Solid cast brass construction with washerless ceramic disc mixing cartridge type, rigid gooseneck spout with outlet 102 mm to 127 mm (4 inches to 5 inches) above slab with 102 mm (4 inches) wrist blade handles. Provide laminar flow control device. Faucet, wall and

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floor escutcheons shall be either copper alloy or CRS. Exposed metal parts shall be chrome plated with a smooth bright finish.

2. Drain: cast or wrought brass with flat grid strainer, offset tailpiece, brass, chrome plated.
3. Stops: Angle type. See paragraph 2.2. Stops
4. Trap: Cast copper alloy, 38 mm by 32 mm (1 1/2 inches by 1 1/4 inches) P-trap, adjustable with connected elbow and 1.4mm thick (17 gauge) tubing extension to wall. Exposed metal trap surface and connection hardware shall be chrome plated with a smooth bright finish. Set trap parallel to the wall.
5. Provide cover for drain, stops and trap per A.D.A 4-19.4.

**2.9 SINKS**

- A. Dimensions for sinks tubs are specified, length by width (distance from wall) and depth.
- B. (P-502) Service Sink (Corner, Floor Mounted) stain resistant terrazzo, 711 mm by 711 mm by 305 mm (28 inches by 28 inches by 12 inches) with 152 mm (6 inches) drop front. Terrazzo, composed of marble chips and white Portland cement, shall develop compressive strength of 20684 kPa (3000 psi) seven days after casting. Provide extruded aluminum cap on front side.
  1. Faucet: Solid brass construction, combination faucet with replaceable monel seat, removable replacement unit containing all parts subject to wear, integral stops, mounted on wall above sink. Spout shall have a pail hook, 19 mm (3/4 inch) hose coupling threads, vacuum breaker, and top or bottom brace to wall. Four-arm handles on faucets shall be cast, formed, or drop forged copper alloy. Escutcheons shall be either forged copper alloy or CRS. Exposed metal parts, including exposed part under valve handle when in open position, shall have a smooth bright finish. Provide 914 mm (36 inches) hose with wall hook. Centerline of rough in is 1219 mm (48 inches) above finished floor.
  2. Drain: Seventy six millimeter (3 inches) cast brass drain with nickel bronze strainer.
  3. Trap: P-trap, drain through floor.
- C. (P-528) Sink (CRS, Single Compartment, Counter Top ASME/ANSI A112.19.2M, Kitchen Sinks, Figure 5) undermount stainless steel, approximately 533 mm by 559 mm (21 inches by 22 inches) with single compartment inside dimensions approximately 406 mm by 483 mm by 191 mm (16 inches by 19 inches by 7 1/2 inches) deep. Shall be minimum of 1.3 mm thick (18 gauge) CRS. Corners and edges shall be well rounded:

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1. Faucet: Solid brass construction, deck mounted combination faucet with monel or ceramic seats, removable replacement unit containing all parts subject to ware, swivel gooseneck spout with approximately 203 mm (8 inches) reach with spout outlet 152 mm (6 inches above deck and 102 mm (4 inches) wrist blades. Faucet shall be polished chrome plated.
  2. Drain: Drain plug with cup strainer, stainless steel.
  3. Trap: Cast copper alloy 38 mm (1 1/2 inches) P-trap with cleanout plug. Provide wall connection and escutcheon.
  4. Provide cover for drain, stops and trap per A.D.A 4-19.4.
- D. (P-529) Sink (CRS, Single Compartment, Counter Top ASME/ANSI A112.19.2M, Kitchen Sinks, Figure 5) undermount vitreous china, approximately 533 mm by 559 mm (21 inches by 22 inches) with single compartment inside dimensions approximately 406 mm by 483 mm by 191 mm (16 inches by 19 inches by 7-1/2 inches) deep.
1. Faucet: Solid brass construction, deck mounted single faucet with monel or ceramic seats, removable replacement unit containing all parts subject to ware, swivel gooseneck spout with approximately 203 mm (8 inches) reach with spout outlet 152 mm (6 inches) above deck and floor mounted mechanical pedal mixing valve with self closing pedal valves with stops. Faucet shall be polished chrome plated.
  2. Drain: Drain plug with cup strainer, stainless steel.
  3. Trap: Cast copper alloy 38 mm (1 1/2 inches) P-trap with cleanout plug. Provide wall connection and escutcheon.
  4. Provide cover for drain, stops, and trap per A.D.A. 4-19.4.

**2.10 DISPENSER, DRINKING WATER**

- A. Standard rating conditions: 10 degrees C (50 degrees F) water with 27 degrees C (80 degrees F) inlet water temperature and 32 degrees C (90 degrees F) ambient air temperature.
- B. (P-609) Electric Water Cooler: Mechanically cooled, wheel chair, bubbler style fully exposed dual height stainless steel fountain, remote refrigeration system, stainless steel support arm, energy efficient cooling system consisting of a hermetically sealed reciprocating type compressor, 115v, 60Hz, single phase, fan cooled condenser, permanently lubricated fan motor. Set highest bubbler 1016mm (40 inches) above finished floor and ADA accessible bubbler 36 inches above floor.

**2.11 EMERGENCY FIXTURES**

- A. (P-708) Emergency Eye and Face Wash (Wall Mounted): CRS, wall mounted, foot pedal control. Mount eye and face wash spray heads 1067 mm (42 inches) above finished floor. Pedal shall be wall mounted, entirely

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clear of floor, and be hinged to permit turning up. Receptor shall be complete with drain plug with perforated strainer, P-trap and waste connection to wall with escutcheon.

**2.12 HYDRANT, HOSE BIBB AND MISCELLANEOUS DEVICES**

- A. (P-804) Hose Bibb (Single Faucet, Wall Mounted to Exposed Supply Pipe): Cast or wrought copper alloy, single faucet with replaceable monel seat, removable replacement unit containing all parts subject to wear, mounted on wall 914 mm (36 inches) above floor to concealed supply pipe. Provide faucet with 19 mm (3/4 inch) hose coupling thread on spout and vacuum breaker. Four-arm handle on faucet shall be cast, formed or drop forged copper alloy. Escutcheons shall be either forged copper alloy or CRS. Exposed metal parts, including exposed part under valve handle when in open position, shall have a bright finish.

**PART 3 - EXECUTION**

**3.1 INSTALLATION**

- A. Fixture Setting: Opening between fixture and floor and wall finish shall be sealed as specified under Section 07 92 00, JOINT SEALANTS.
- B. Supports and Fastening: Secure all fixtures, equipment and trimmings to partitions, walls and related finish surfaces. Exposed heads of bolts and nuts in finished rooms shall be hexagonal, polished chrome plated brass with rounded tops.
- C. Through Bolts: For free standing marble and metal stud partitions refer to Section 10 21 13, TOILET COMPARTMENTS.
- D. Toggle Bolts: For hollow masonry units, finished or unfinished.
- E. Expansion Bolts: For brick or concrete or other solid masonry. Shall be 6 mm (1/4 inch) diameter bolts, and to extend at least 76 mm (3 inches) into masonry and be fitted with loose tubing or sleeves extending into masonry. Wood plugs, fiber plugs, lead or other soft metal shields are prohibited.
- F. Power Set Fasteners: May be used for concrete walls, shall be 6 mm (1/4 inch) threaded studs, and shall extend at least 32 mm (1 1/4 inches) into wall.
- G. Tightly cover and protect fixtures and equipment against dirt, water and chemical or mechanical injury.
- H. Where water closet waste pipe has to be offset due to beam interference, provide correct and additional piping necessary to eliminate relocation of water closet.
- I. Do not use aerators on lavatories and sinks.

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### 3.2 CLEANING

At completion of all work, fixtures, exposed materials and equipment shall be thoroughly cleaned.

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SECTION 23 05 11  
COMMON WORK RESULTS FOR HVAC

PART 1 - GENERAL

1.1 DESCRIPTION

- A. The requirements of this Section apply to all sections of Division 23.
- B. Definitions:
  - 1. Exposed: Piping, ductwork, and equipment exposed to view in finished rooms.
  - 2. Option or optional: Contractor's choice of an alternate material or method.
  - 3. RE: Resident Engineer
  - 4. COTR: Contracting Officer's Technical Representative.

1.2 RELATED WORK

- A. Section 00 72 00, GENERAL CONDITIONS
- B. Section 01 00 00, GENERAL REQUIREMENTS
- C. Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, and SAMPLES
- D. Section 02 82 11, TRADITIONAL ASBESTOS ABATEMENT
- E. Section 03 30 00, CAST-IN-PLACE CONCRETE: Concrete and Grout
- F. Section 07 84 00, FIRESTOPPING
- G. Section 07 92 00, JOINT SEALANTS
- H. Section 09 91 00, PAINTING
- I. Section 13 05 41, SEISMIC RESTRAINT REQUIREMENTS FOR NON-STRUCTURAL COMPONENTS. Section 23 05 12, GENERAL MOTOR REQUIREMENTS FOR HVAC and STEAM GENERATION
- J. Section 23 05 41, NOISE AND VIBRATION CONTROL FOR HVAC PIPING and EQUIPMENT
- K. Section 23 05 93, TESTING, ADJUSTING, and BALANCING FOR HVAC
- L. Section 23 07 11, HVAC, PLUMBING, and Boiler Plant Insulation
- M. Section 23 09 23, DIRECT-DIGITAL CONTROL SYSTEM FOR HVAC
- N. Section 23 21 13, HYDRONIC PIPING
- O. Section 23 21 23, HYDRONIC PUMPS
- P. Section 23 22 13, STEAM and CONDENSATE HEATING PIPING
- Q. Section 23 22 23, STEAM CONDENSATE PUMPS
- R. Section 23 25 00, HVAC WATER TREATMENT
- S. Section 23 31 00, HVAC DUCTS and CASINGS
- T. Section 23 34 00, HVAC FANS
- U. Section 23 36 00, AIR TERMINAL UNITS
- V. Section 23 37 00, AIR OUTLETS and INLETS
- W. Section 23 40 00, HVAC AIR CLEANING DEVICES
- X. Section 23 73 00, INDOOR CENTRAL-STATION AIR-HANDLING UNITS

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- Y. Section 23 82 00, CONVECTION HEATING and COOLING UNITS
- Z. Section 23 82 16, AIR COILS
- AA. Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS
- BB. Section 26 29 11, LOW-VOLTAGE MOTOR STARTERS

**1.3 QUALITY ASSURANCE**

- A. Mechanical, electrical and associated systems shall be safe, reliable, efficient, durable, easily and safely operable and maintainable, easily and safely accessible, and in compliance with applicable codes as specified. The systems shall be comprised of high quality institutional-class and industrial-class products of manufacturers that are experienced specialists in the required product lines. All construction firms and personnel shall be experienced and qualified specialists in industrial and institutional HVAC
- B. Flow Rate Tolerance for HVAC Equipment: Section 23 05 93, TESTING, ADJUSTING, AND BALANCING FOR HVAC.
- C. Equipment Vibration Tolerance:
  - 1. Refer to Section 23 05 41, NOISE AND VIBRATION CONTROL FOR HVAC PIPING and EQUIPMENT. Equipment shall be factory-balanced to this tolerance and re-balanced on site, as necessary.
  - 2. After HVAC air balance work is completed and permanent drive sheaves are in place, perform field mechanical balancing and adjustments required to meet the specified vibration tolerance.
- D. Products Criteria:
  - 1. Standard Products: Material and equipment shall be the standard products of a manufacturer regularly engaged in the manufacture of the products for at least 3 years (or longer as specified elsewhere). The design, model and size of each item shall have been in satisfactory and efficient operation on at least three installations for approximately three years. However, digital electronics devices, software and systems such as controls, instruments, computer work station, shall be the current generation of technology and basic design that has a proven satisfactory service record of at least three years. See other specification sections for any exceptions and/or additional requirements.
  - 2. All items furnished shall be free from defects that would adversely affect the performance, maintainability and appearance of individual components and overall assembly.
  - 3. Conform to codes and standards as required by the specifications. Conform to local codes, if required by local authorities such as the



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- natural gas supplier, if the local codes are more stringent than those specified. Refer any conflicts to the Resident Engineer.
4. Multiple Units: When two or more units of materials or equipment of the same type or class are required, these units shall be products of one manufacturer.
  5. Assembled Units: Manufacturers of equipment assemblies, which use components made by others, assume complete responsibility for the final assembled product.
  6. Nameplates: Nameplate bearing manufacturer's name or identifiable trademark shall be securely affixed in a conspicuous place on equipment, or name or trademark cast integrally with equipment, stamped or otherwise permanently marked on each item of equipment.
  7. Asbestos products or equipment or materials containing asbestos shall not be used.
- E. Equipment Service Organizations:
1. HVAC: Products and systems shall be supported by service organizations that maintain a complete inventory of repair parts and are located within 50 miles to the site.
- F. HVAC Mechanical Systems Welding: Before any welding is performed, contractor shall submit a certificate certifying that welders comply with the following requirements:
1. Qualify welding processes and operators for piping according to ASME "Boiler and Pressure Vessel Code", Section IX, "Welding and Brazing Qualifications".
  2. Comply with provisions of ASME B31 series "Code for Pressure Piping".
  3. Certify that each welder has passed American Welding Society (AWS) qualification tests for the welding processes involved, and that certification is current.
- G. Execution (Installation, Construction) Quality:
1. Apply and install all items in accordance with manufacturer's written instructions. Refer conflicts between the manufacturer's instructions and the contract drawings and specifications to the Resident Engineer for resolution. Provide written hard copies or computer files of manufacturer's installation instructions to the Resident Engineer at least two weeks prior to commencing installation of any item. Installation of the item will not be allowed to proceed until the recommendations are received. Failure to furnish these recommendations is a cause for rejection of the material.

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2. Provide complete layout drawings required by Paragraph, SUBMITTALS.  
Do not commence construction work on any system until the layout drawings have been approved.

H. Upon request by Government, provide lists of previous installations for selected items of equipment. Include contact persons who will serve as references, with telephone numbers and e-mail addresses.

**1.4 SUBMITTALS**

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES, and with requirements in the individual specification sections.
- B. Contractor shall make all necessary field measurements and investigations to assure that the equipment and assemblies will meet contract requirements.
- C. If equipment is submitted which differs in arrangement from that shown, provide drawings that show the rearrangement of all associated systems. Approval will be given only if all features of the equipment and associated systems, including accessibility, are equivalent to that required by the contract.
- D. Prior to submitting shop drawings for approval, contractor shall certify in writing that manufacturers of all major items of equipment have each reviewed drawings and specifications, and have jointly coordinated and properly integrated their equipment and controls to provide a complete and efficient installation.
- E. Submittals and shop drawings for interdependent items, containing applicable descriptive information, shall be furnished together and complete in a group. Coordinate and properly integrate materials and equipment in each group to provide a completely compatible and efficient.
- F. Layout Drawings:
  1. Submit complete consolidated and coordinated layout drawings for all new systems, and for existing systems that are in the same areas.  
Refer to Section 00 72 00, GENERAL CONDITIONS, Article, SUBCONTRACTS AND WORK COORDINATION.
  2. The drawings shall include plan views, elevations and sections of all systems and shall be on a scale of not less than 1:32 (3/8-inch equal to one foot). Clearly identify and dimension the proposed locations of the principal items of equipment. The drawings shall clearly show locations and adequate clearance for all equipment, piping, valves, control panels and other items. Show the access means for all items

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- requiring access for operations and maintenance. Provide detailed layout drawings of all piping and duct systems.
3. Do not install equipment foundations, equipment or piping until layout drawings have been approved.
  4. In addition, for HVAC systems, provide details of the following:
    - a. Mechanical equipment rooms, and areas of high congestion of various systems requiring careful coordination.
    - b. Hangers, inserts, supports, and bracing.
    - c. Pipe sleeves.
    - d. Duct or equipment penetrations of floors, walls, ceilings, or roofs.
- G. Manufacturer's Literature and Data: Submit under the pertinent section rather than under this section.
1. Submit belt drive with the driven equipment. Submit selection data for specific drives when requested by the Resident Engineer.
  2. Submit electric motor data and variable speed drive data with the driven equipment.
  3. Equipment and materials identification.
  4. Fire-stopping materials.
  5. Hangers, inserts, supports and bracing. Provide load calculations for variable spring and constant support hangers.
  6. Wall, floor, and ceiling plates.
- H. HVAC Maintenance Data and Operating Instructions:
1. Maintenance and operating manuals in accordance with Section 01 00 00, GENERAL REQUIREMENTS, Article, INSTRUCTIONS, for systems and equipment.
  2. Provide a listing of recommended replacement parts for keeping in stock supply, including sources of supply, for equipment. Include in the listing belts for equipment: Belt manufacturer, model number, size and style, and distinguished whether of multiple belt sets.
- I. Provide copies of approved HVAC equipment submittals to the Testing, Adjusting and Balancing Subcontractor.

**1.5 APPLICABLE PUBLICATIONS**

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.
- B. Air Conditioning, Heating and Refrigeration Institute (AHRI):  
430-2009 .....Central Station Air-Handling Units
- C. American National Standard Institute (ANSI):  
B31.1-2007 .....Power Piping

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- D. Rubber Manufacturers Association (ANSI/RMA):
  - IP-20-2007 .....Specifications for Drives Using Classical  
V-Belts and Sheaves
  - IP-21-2009 .....Specifications for Drives Using Double-V  
(Hexagonal) Belts
  - IP-22-2007 .....Specifications for Drives Using Narrow V-Belts  
and Sheaves
- E. Air Movement and Control Association (AMCA):
  - 410-96 .....Recommended Safety Practices for Air Moving  
Devices
- F. American Society of Mechanical Engineers (ASME):
  - Boiler and Pressure Vessel Code (BPVC):
  - Section IX-2007 .....Welding and Brazing Qualifications
  - Code for Pressure Piping:
  - B31.1-2007 .....Power Piping
- G. American Society for Testing and Materials (ASTM):
  - A36/A36M-08 .....Standard Specification for Carbon Structural  
Steel
  - A575-96(2007) .....Standard Specification for Steel Bars, Carbon,  
Merchant Quality, M-Grades
  - E84-10 .....Standard Test Method for Surface Burning  
Characteristics of Building Materials
  - E119-09c .....Standard Test Methods for Fire Tests of Building  
Construction and Materials
- H. Manufacturers Standardization Society (MSS) of the Valve and Fittings  
Industry, Inc:
  - SP-58-2009 .....Pipe Hangers and Supports-Materials, Design and  
Manufacture, Selection, Application, and  
Installation
  - SP 69-2003 .....Pipe Hangers and Supports-Selection and  
Application
  - SP 127-2001 .....Bracing for Piping Systems, Seismic - Wind -  
Dynamic, Design, Selection, Application
- I. National Electrical Manufacturers Association (NEMA):
  - MG-1-2009 .....Motors and Generators
- J. National Fire Protection Association (NFPA):
  - 70-08 .....National Electrical Code
  - 90A-09 .....Standard for the Installation of Air  
Conditioning and Ventilating Systems
  - 101-09 .....Life Safety Code

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**1.6 DELIVERY, STORAGE AND HANDLING**

**A. Protection of Equipment:**

1. Equipment and material placed on the job site shall remain in the custody of the Contractor until phased acceptance, whether or not the Government has reimbursed the Contractor for the equipment and material. The Contractor is solely responsible for the protection of such equipment and material against any damage.
2. Place damaged equipment in first class, new operating condition; or, replace same as determined and directed by the Resident Engineer. Such repair or replacement shall be at no additional cost to the Government.
3. Protect interiors of new equipment and piping systems against entry of foreign matter. Clean both inside and outside before painting or placing equipment in operation.
4. Existing equipment and piping being worked on by the Contractor shall be under the custody and responsibility of the Contractor and shall be protected as required for new work.

**B. Cleanliness of Piping and Equipment Systems:**

1. Exercise care in storage and handling of equipment and piping material to be incorporated in the work. Remove debris arising from cutting, threading and welding of piping.
2. Piping systems shall be flushed, blown or pigged as necessary to deliver clean systems.
3. Clean interior of all tanks prior to delivery for beneficial use by the Government.
4. Contractor shall be fully responsible for all costs, damage, and delay arising from failure to provide clean systems.

**1.7 JOB CONDITIONS - WORK IN EXISTING BUILDING**

- A. Building Operation: Government employees will be continuously operating and managing all facilities, including temporary facilities, that serve the medical center.
- B. Maintenance of Service: Schedule all work to permit continuous service as required by the medical center.
- C. Steam and Condensate Service Interruptions: Limited steam and condensate service interruptions, as required for interconnections of new and existing systems, will be permitted by the Resident Engineer during periods when the demands are not critical to the operation of the medical center. These non-critical periods are limited to between 8 pm and 5 am in the appropriate off-season (if applicable). Provide at least one week advance notice to the Resident Engineer.

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- D. Phasing of Work: Comply with all requirements shown on drawings or specified.
- E. Building Working Environment: Maintain the architectural and structural integrity of the building and the working environment at all times. Maintain the interior of building at 18 degrees C (65 degrees F) minimum. Limit the opening of doors, windows or other access openings to brief periods as necessary for rigging purposes. No storm water or ground water leakage permitted. Provide daily clean-up of construction and demolition debris on all floor surfaces and on all equipment being operated by VA.
- F. Acceptance of Work for Government Operation: As new facilities are made available for operation and these facilities are of beneficial use to the Government, inspections will be made and tests will be performed. Based on the inspections, a list of contract deficiencies will be issued to the Contractor. After correction of deficiencies as necessary for beneficial use, the Contracting Officer will process necessary acceptance and the equipment will then be under the control and operation of Government personnel.
- G. Temporary Facilities: Refer to Article, TEMPORARY PIPING AND EQUIPMENT in this section.

**PART 2 - PRODUCTS**

**2.1 FACTORY-ASSEMBLED PRODUCTS**

- A. Provide maximum standardization of components to reduce spare part requirements.
- B. Manufacturers of equipment assemblies that include components made by others shall assume complete responsibility for final assembled unit.
  - 1. All components of an assembled unit need not be products of same manufacturer.
  - 2. Constituent parts that are alike shall be products of a single manufacturer.
  - 3. Components shall be compatible with each other and with the total assembly for intended service.
  - 4. Contractor shall guarantee performance of assemblies of components, and shall repair or replace elements of the assemblies as required to deliver specified performance of the complete assembly.
- C. Components of equipment shall bear manufacturer's name and trademark, model number, serial number and performance data on a name plate securely affixed in a conspicuous place, or cast integral with, stamped or otherwise permanently marked upon the components of the equipment.

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- D. Major items of equipment, which serve the same function, must be the same make and model. Exceptions will be permitted if performance requirements cannot be met.

**2.2 COMPATIBILITY OF RELATED EQUIPMENT**

Equipment and materials installed shall be compatible in all respects with other items being furnished and with existing items so that the result will be a complete and fully operational plant that conforms to contract requirements.

**2.3 BELT DRIVES**

- A. Type: ANSI/RMA standard V-belts with proper motor pulley and driven sheave. Belts shall be constructed of reinforced cord and rubber.
- B. Dimensions, rating and selection standards: ANSI/RMA IP-20 and IP-21.
- C. Minimum Horsepower Rating: Motor horsepower plus recommended ANSI/RMA service factor (not less than 20 percent) in addition to the ANSI/RMA allowances for pitch diameter, center distance, and arc of contact.
- D. Maximum Speed: 25 m/s (5000 feet per minute).
- E. Adjustment Provisions: For alignment and ANSI/RMA standard allowances for installation and take-up.
- F. Drives may utilize a single V-Belt (any cross section) when it is the manufacturer's standard.
- G. Multiple Belts: Matched to ANSI/RMA specified limits by measurement on a belt measuring fixture. Seal matched sets together to prevent mixing or partial loss of sets. Replacement, when necessary, shall be an entire set of new matched belts.
- H. Sheaves and Pulleys:
  - 1. Material: Pressed steel, or close grained cast iron.
  - 2. Bore: Fixed or bushing type for securing to shaft with keys.
  - 3. Balanced: Statically and dynamically.
  - 4. Groove spacing for driving and driven pulleys shall be the same.
- I. Drive Types, Based on ARI 435:
  - 1. Provide adjustable-pitch //or fixed-pitch// drive as follows:
    - a. Fan speeds up to 1800 RPM: 7.5 kW (10 horsepower) and smaller.
    - b. Fan speeds over 1800 RPM: 2.2 kW (3 horsepower) and smaller.
  - 2. Provide fixed-pitch drives for drives larger than those listed above.
  - 3. The final fan speeds required to just meet the system CFM and pressure requirements, without throttling, shall be determined by adjustment of a temporary adjustable-pitch motor sheave or by fan law calculation if a fixed-pitch drive is used initially.

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**2.4 DRIVE GUARDS**

- A. For machinery and equipment, provide guards as shown in AMCA 410 for belts, chains, couplings, pulleys, sheaves, shafts, gears and other moving parts regardless of height above the floor to prevent damage to equipment and injury to personnel. Drive guards may be excluded where motors and drives are inside factory fabricated air handling unit casings.
- B. Pump shafts and couplings shall be fully guarded by a sheet steel guard, covering coupling and shaft but not bearings. Material shall be minimum 16-gage sheet steel; ends shall be braked and drilled and attached to pump base with minimum of four 6 mm (1/4-inch) bolts. Reinforce guard as necessary to prevent side play forcing guard onto couplings.
- C. V-belt and sheave assemblies shall be totally enclosed, firmly mounted, non-resonant. Guard shall be an assembly of minimum 22-gage sheet steel and expanded or perforated metal to permit observation of belts. 25 mm (one-inch) diameter hole shall be provided at each shaft centerline to permit speed measurement.
- D. Materials: Sheet steel, cast iron, expanded metal or wire mesh rigidly secured so as to be removable without disassembling pipe, duct, or electrical connections to equipment.
- E. Access for Speed Measurement: 25 mm (One inch) diameter hole at each shaft center.

**2.5 LIFTING ATTACHMENTS**

Provide equipment with suitable lifting attachments to enable equipment to be lifted in its normal position. Lifting attachments shall withstand any handling conditions that might be encountered, without bending or distortion of shape, such as rapid lowering and braking of load.

**2.6 ELECTRIC MOTORS**

- A. All material and equipment furnished and installation methods shall conform to the requirements of Section 23 05 12, GENERAL MOTOR REQUIREMENTS FOR HVAC AND STEAM GENERATION EQUIPMENT; Section 26 29 11, LOW-VOLTAGE MOTOR STARTERS; and, Section 26 05 21, LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES (600 VOLTS AND BELOW). Provide all electrical wiring, conduit, and devices necessary for the proper connection, protection and operation of the systems. Provide special energy efficient premium efficiency type motors as scheduled.

**2.7 VARIABLE SPEED MOTOR CONTROLLERS**

- A. Refer to Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS and Section 26 29 11, LOW-VOLTAGE MOTOR STARTERS for specifications.



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- B. The combination of controller and motor shall be provided by the manufacturer of the driven equipment, such as pumps and fans, and shall be rated for 100 percent output performance. Multiple units of the same class of equipment, i.e. air handlers, fans, pumps, shall be product of a single manufacturer.
- C. Motors shall be premium efficiency type and be approved by the motor controller manufacturer. The controller-motor combination shall be guaranteed to provide full motor nameplate horsepower in variable frequency operation. Both driving and driven motor/fan sheaves shall be fixed pitch.
- D. Controller shall not add any current or voltage transients to the input AC power distribution system, DDC controls, sensitive medical equipment, etc., nor shall be affected from other devices on the AC power system.
- E. Controller shall be provided with the following operating features and accessories:
  - 1. Suitable for variable torque load.
  - 2. Provide thermal magnetic circuit breaker or fused switch with external operator and incoming line fuses. Unit shall be rated for minimum 25,000 AIC. Provide AC input line reactors (3% impedance) filters on incoming power line. Provide output line reactors on line between drive and motor for motors over 50 HP or where the distance between the breaker and motor exceeds 50 feet.

**2.8 EQUIPMENT AND MATERIALS IDENTIFICATION**

- A. Use symbols, nomenclature and equipment numbers specified, shown on the drawings and shown in the maintenance manuals (verify with COTR or RE). In addition, provide bar code identification nameplate for all equipment which will allow the equipment identification code to be scanned into the system for maintenance and inventory tracking. Identification for piping is specified in Section 09 91 00, PAINTING.
- B. Interior (Indoor) Equipment: Engraved nameplates, with letters not less than 48 mm (3/16-inch) high of brass with black-filled letters, or rigid black plastic with white letters specified in Section 09 91 00, PAINTING permanently fastened to the equipment. Identify unit components such as coils, filters, fans, etc.
- C. Exterior (Outdoor) Equipment: Brass nameplates, with engraved black filled letters, not less than 48 mm (3/16-inch) high riveted or bolted to the equipment (verify with COTR or RE).
- D. Control Items: Label all temperature and humidity sensors, controllers and control dampers. Identify and label each item as they appear on the control diagrams.

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**E. Valve Tags and Lists:**

1. HVAC and Boiler Plant: Provide for all valves other than for equipment in Section 23 82 00, CONVECTION HEATING AND COOLING UNITS.
2. Valve tags: Engraved black filled numbers and letters not less than 13 mm (1/2-inch) high for number designation, and not less than 6.4 mm(1/4-inch) for service designation on 19 gage 38 mm (1-1/2 inches) round brass disc, attached with brass "S" hook or brass chain.
3. Valve lists: Typed or printed plastic coated card(s), sized 216 mm(8-1/2 inches) by 280 mm (11 inches) showing tag number, valve function and area of control, for each service or system. Punch sheets for a 3-ring notebook.
4. Provide detailed plan for each floor of the building indicating the location and valve number for each valve. Identify location of each valve with a color coded thumb tack in ceiling.

**2.9 FIRESTOPPING**

Section 07 84 00, FIRESTOPPING specifies an effective barrier against the spread of fire, smoke and gases where penetrations occur for piping and ductwork. Refer to Section 23 07 11, HVAC, PLUMBING, AND BOILER PLANT INSULATION, for firestop pipe and duct insulation.

**2.10 GALVANIZED REPAIR COMPOUND**

Mil. Spec. DOD-P-21035B, paint form.

**2.11 HVAC PIPE AND EQUIPMENT SUPPORTS AND RESTRAINTS**

- A. Vibration Isolators: Refer to Section 23 05 41, NOISE AND VIBRATION CONTROL FOR HVAC PIPING AND EQUIPMENT.
- B. Pipe Supports: Comply with MSS SP-58. Type Numbers specified refer to this standard. For selection and application comply with MSS SP-69. Refer to Section 05 50 00, METAL FABRICATIONS, for miscellaneous metal support materials and prime coat painting requirements.
- C. Attachment to Concrete Building Construction:
  1. Concrete insert: MSS SP-58, Type 18.
  2. Self-drilling expansion shields and machine bolt expansion anchors: Permitted in concrete not less than 102 mm (four inches) thick when approved by the Resident Engineer for each job condition.
  3. Power-driven fasteners: Permitted in existing concrete or masonry not less than 102 mm (four inches) thick when approved by the Resident Engineer for each job condition.
- D. Attachment to Steel Building Construction:
  1. Welded attachment: MSS SP-58, Type 22.

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2. Beam clamps: MSS SP-58, Types 20, 21, 28 or 29. Type 23 C-clamp may be used for individual copper tubing up to 23mm (7/8-inch) outside diameter.
- E. Attachment to existing structure: Support from existing floor/roof frame.
- F. Hanger Rods: Hot-rolled steel, ASTM A36 or A575 for allowable load listed in MSS SP-58. For piping, provide adjustment means for controlling level or slope. Types 13 or 15 turn-buckles shall provide 38 mm (1-1/2 inches) minimum of adjustment and incorporate locknuts. All-thread rods are acceptable.
- G. Hangers Supporting Multiple Pipes (Trapeze Hangers): Galvanized, cold formed, lipped steel channel horizontal member, not less than 41 mm by 41 mm (1-5/8 inches by 1-5/8 inches), 2.7 mm (No. 12 gage), designed to accept special spring held, hardened steel nuts. Not permitted for steam supply and condensate piping.
  1. Allowable hanger load: Manufacturers rating less 91kg (200 pounds).
  2. Guide individual pipes on the horizontal member of every other trapeze hanger with 6 mm (1/4-inch) U-bolt fabricated from steel rod. Provide Type 40 insulation shield, secured by two 13mm (1/2-inch) galvanized steel bands, or preinsulated calcium silicate shield for insulated piping at each hanger.
- H. Supports for Piping Systems:
  1. Select hangers sized to encircle insulation on insulated piping. Refer to Section 23 07 11, HVAC, PLUMBING, AND BOILER PLANT INSULATION for insulation thickness. To protect insulation, provide Type 39 saddles for roller type supports or preinsulated calcium silicate shields. Provide Type 40 insulation shield or preinsulated calcium silicate shield at all other types of supports and hangers including those for preinsulated piping.
  2. Piping Systems except High and Medium Pressure Steam (MSS SP-58):
    - a. Standard clevis hanger: Type 1; provide locknut.
    - b. Riser clamps: Type 8.
    - c. Wall brackets: Types 31, 32 or 33.
    - d. Roller supports: Type 41, 43, 44 and 46.
    - e. Saddle support: Type 36, 37 or 38.
    - f. Turnbuckle: Types 13 or 15. Preinsulate.
    - g. U-bolt clamp: Type 24.
    - h. Copper Tube:
      - 1) Hangers, clamps and other support material in contact with tubing shall be painted with copper colored epoxy paint,

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- plastic coated or taped with non adhesive isolation tape to prevent electrolysis.
- 2) For vertical runs use epoxy painted or plastic coated riser clamps.
- 3) For supporting tube to strut: Provide epoxy painted pipe straps for copper tube or plastic inserted vibration isolation clamps.
- 4) Insulated Lines: Provide pre-insulated calcium silicate shields sized for copper tube.
- i. Supports for plastic or glass piping: As recommended by the pipe manufacturer with black rubber tape extending one inch beyond steel support or clamp.
- 3. High and Medium Pressure Steam (MSS SP-58):
  - a. Provide eye rod or Type 17 eye nut near the upper attachment.
  - b. Piping 50 mm (2 inches) and larger: Type 43 roller hanger. For roller hangers requiring seismic bracing provide a Type 1 clevis hanger with Type 41 roller attached by flat side bars.
  - c. Piping with Vertical Expansion and Contraction:
    - 1) Movement up to 20 mm (3/4-inch): Type 51 or 52 variable spring unit with integral turn buckle and load indicator.
    - 2) Movement more than 20 mm (3/4-inch): Type 54 or 55 constant support unit with integral adjusting nut, turn buckle and travel position indicator.
- 4. Convertor and Expansion Tank Hangers: May be Type 1 sized for the shell diameter. Insulation where required will cover the hangers.
- I. Pre-insulated Calcium Silicate Shields:
  - 1. Provide 360 degree water resistant high density 965 kPa (140 psi) compressive strength calcium silicate shields encased in galvanized metal.
  - 2. Pre-insulated calcium silicate shields to be installed at the point of support during erection.
  - 3. Shield thickness shall match the pipe insulation.
  - 4. The type of shield is selected by the temperature of the pipe, the load it must carry, and the type of support it will be used with.
    - a. Shields for supporting chilled or cold water shall have insulation that extends a minimum of 1 inch past the sheet metal. Provide for an adequate vapor barrier in chilled lines.
    - b. The pre-insulated calcium silicate shield shall support the maximum allowable water filled span as indicated in MSS-SP 69. To support the load, the shields may have one or more of the following features: structural inserts 4138 kPa (600 psi)

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compressive strength, an extra bottom metal shield, or formed structural steel (ASTM A36) wear plates welded to the bottom sheet metal jacket.

5. Shields may be used on steel clevis hanger type supports, roller supports or flat surfaces.

J. Seismic Restraint of Piping and Ductwork: Refer to Section 13 05 41, SEISMIC RESTRAINT REQUIREMENTS FOR NON-STRUCTURAL COMPONENTS. Comply with MSS SP-127.

**2.12 PIPE PENETRATIONS**

- A. Install sleeves during construction for other than blocked out floor openings for risers in mechanical bays.
- B. To prevent accidental liquid spills from passing to a lower level, provide the following:
1. For sleeves: Extend sleeve 25 mm (one inch) above finished floor and provide sealant for watertight joint.
  2. For blocked out floor openings: Provide 40 mm (1-1/2 inch) angle set in silicone adhesive around opening.
  3. For drilled penetrations: Provide 40 mm (1-1/2 inch) angle ring or square set in silicone adhesive around penetration.
- C. Penetrations are not allowed through beams or ribs, but may be installed in concrete beam flanges. Any deviation from these requirements must receive prior approval of Resident Engineer.
- D. Sheet Metal, Plastic, or Moisture-resistant Fiber Sleeves: Provide for pipe passing through floors, interior walls, and partitions, unless brass or steel pipe sleeves are specifically called for below.
- E. Cast Iron or Zinc Coated Pipe Sleeves: Provide for pipe passing through exterior walls below grade. Make space between sleeve and pipe watertight with a modular or link rubber seal. Seal shall be applied at both ends of sleeve.
- F. Galvanized Steel or an alternate Black Iron Pipe with asphalt coating Sleeves: Provide for pipe passing through concrete beam flanges, except where brass pipe sleeves are called for. Provide sleeve for pipe passing through floor of mechanical rooms, laundry work rooms, and animal rooms above basement. Except in mechanical rooms, connect sleeve with floor plate.
- G. Brass Pipe Sleeves: Provide for pipe passing through quarry tile, terrazzo or ceramic tile floors. Connect sleeve with floor plate.
- H. Sleeves are not required for wall hydrants for fire department connections or in drywall construction.

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- I. Sleeve Clearance: Sleeve through floors, walls, partitions, and beam flanges shall be one inch greater in diameter than external diameter of pipe. Sleeve for pipe with insulation shall be large enough to accommodate the insulation. Interior openings shall be caulked tight with fire stopping material and sealant to prevent the spread of fire, smoke, and gases.
- J. Sealant and Adhesives: Shall be as specified in Section 07 92 00, JOINT SEALANTS.

**2.13 DUCT PENETRATIONS**

- A. Provide curbs for roof mounted piping, ductwork and equipment. Curbs shall be 18 inches high with continuously welded seams, built-in cant strip, interior baffle with acoustic insulation, curb bottom, hinged curb adapter.
- B. Provide firestopping for openings through fire and smoke barriers, maintaining minimum required rating of floor, ceiling or wall assembly. See section 07 84 00, FIRESTOPPING.

**2.14 SPECIAL TOOLS AND LUBRICANTS**

- A. Furnish, and turn over to the Resident Engineer, tools not readily available commercially, that are required for disassembly or adjustment of equipment and machinery furnished.
- B. Grease Guns with Attachments for Applicable Fittings: One for each type of grease required for each motor or other equipment.
- C. Refrigerant Tools: Provide system charging/Evacuation equipment, gauges, fittings, and tools required for maintenance of furnished equipment.
- D. Tool Containers: Hardwood or metal, permanently identified for intended service and mounted, or located, where directed by the Resident Engineer.
- E. Lubricants: A minimum of 0.95 L (one quart) of oil, and 0.45 kg (one pound) of grease, of equipment manufacturer's recommended grade and type, in unopened containers and properly identified as to use for each different application.

**2.15 WALL, FLOOR AND CEILING PLATES**

- A. Material and Type: Chrome plated brass or chrome plated steel, one piece or split type with concealed hinge, with set screw for fastening to pipe, or sleeve. Use plates that fit tight around pipes, cover openings around pipes and cover the entire pipe sleeve projection.
- B. Thickness: Not less than 2.4 mm (3/32-inch) for floor plates. For wall and ceiling plates, not less than 0.64 mm (0.025-inch) for up to 80 mm (3-inch pipe), 0.89 mm (0.035-inch) for larger pipe.

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- C. Locations: Use where pipe penetrates floors, walls and ceilings in exposed locations, in finished areas only. Provide a watertight joint in spaces where brass or steel pipe sleeves are specified.

**2.16 ASBESTOS**

Materials containing asbestos are not permitted.

**PART 3 - EXECUTION**

**3.1 ARRANGEMENT AND INSTALLATION OF EQUIPMENT AND PIPING**

- A. Coordinate location of piping, sleeves, inserts, hangers, ductwork and equipment. Locate piping, sleeves, inserts, hangers, ductwork and equipment clear of windows, doors, openings, light outlets, and other services and utilities. Prepare equipment layout drawings to coordinate proper location and personnel access of all facilities. Submit the drawings for review as required by Part 1. Follow manufacturer's published recommendations for installation methods not otherwise specified.
- B. Operating Personnel Access and Observation Provisions: Select and arrange all equipment and systems to provide clear view and easy access, without use of portable ladders, for maintenance and operation of all devices including, but not limited to: all equipment items, valves, filters, strainers, transmitters, sensors, control devices. All gages and indicators shall be clearly visible by personnel standing on the floor or on permanent platforms. Do not reduce or change maintenance and operating space and access provisions that are shown on the drawings.
- C. Equipment and Piping Support: Coordinate structural systems necessary for pipe and equipment support with pipe and equipment locations to permit proper installation.
- D. Location of pipe sleeves, trenches and chases shall be accurately coordinated with equipment and piping locations.
- E. Cutting Holes:
  - 1. Cut holes through concrete and masonry by rotary core drill. Pneumatic hammer, impact electric, and hand or manual hammer type drill will not be allowed, except as permitted by Resident Engineer where working area space is limited.
  - 2. Locate holes to avoid interference with structural members such as beams or grade beams. Holes shall be laid out in advance and drilling done only after approval by Resident Engineer. If the Contractor considers it necessary to drill through structural members, this matter shall be referred to Resident Engineer for approval.
  - 3. Do not penetrate membrane waterproofing.

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- F. Interconnection of Instrumentation or Control Devices: Generally, electrical and pneumatic interconnections are not shown but must be provided.
- G. Minor Piping: Generally, small diameter pipe runs from drips and drains, water cooling, and other service are not shown but must be provided.
- H. Electrical and Pneumatic Interconnection of Controls and Instruments: This generally not shown but must be provided. This includes interconnections of sensors, transmitters, transducers, control devices, control and instrumentation panels, instruments and computer workstations. Comply with NFPA-70.
- I. Protection and Cleaning:
  - 1. Equipment and materials shall be carefully handled, properly stored, and adequately protected to prevent damage before and during installation, in accordance with the manufacturer's recommendations and as approved by the Resident Engineer. Damaged or defective items in the opinion of the Resident Engineer, shall be replaced.
  - 2. Protect all finished parts of equipment, such as shafts and bearings where accessible, from rust prior to operation by means of protective grease coating and wrapping. Close pipe openings with caps or plugs during installation. Tightly cover and protect fixtures and equipment against dirt, water chemical, or mechanical injury. At completion of all work thoroughly clean fixtures, exposed materials and equipment.
- J. Concrete and Grout: Use concrete and shrink compensating grout 25 MPa (3000 psi) minimum, specified in Section 03 30 00, CAST-IN-PLACE CONCRETE.
- K. Install gages, thermometers, valves and other devices with due regard for ease in reading or operating and maintaining said devices. Locate and position thermometers and gages to be easily read by operator or staff standing on floor or walkway provided. Servicing shall not require dismantling adjacent equipment or pipe work.
- L. Install steam piping expansion joints as per manufacturer's recommendations.
- M. Work in Existing Building:
  - 1. Perform as specified in Article, OPERATIONS AND STORAGE AREAS, Article, ALTERATIONS, and Article, RESTORATION of the Section 01 00 00, GENERAL REQUIREMENTS for relocation of existing equipment, alterations and restoration of existing building(s).
  - 2. As specified in Section 01 00 00, GENERAL REQUIREMENTS, Article, OPERATIONS AND STORAGE AREAS, make alterations to existing service



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- piping at times that will least interfere with normal operation of the facility.
3. Cut required openings through existing masonry and reinforced concrete using diamond core drills. Use of pneumatic hammer type drills, impact type electric drills, and hand or manual hammer type drills, will be permitted only with approval of the Resident Engineer. Locate openings that will least effect structural slabs, columns, ribs or beams. Refer to the Resident Engineer for determination of proper design for openings through structural sections and opening layouts approval, prior to cutting or drilling into structure. After Resident Engineer's approval, carefully cut opening through construction no larger than absolutely necessary for the required installation.
- N. Switchgear/Electrical Equipment Drip Protection: Every effort shall be made to eliminate the installation of pipe above electrical and telephone switchgear. If this is not possible, encase pipe in a second pipe with a minimum of joints. Installation of piping, ductwork, leak protection apparatus or other installations foreign to the electrical installation shall be located in the space equal to the width and depth of the equipment and extending from to a height of 1.8 m (6 ft.) above the equipment of to ceiling structure, whichever is lower (NFPA 70).
- O. Inaccessible Equipment:
1. Where the Government determines that the Contractor has installed equipment not conveniently accessible for operation and maintenance, equipment shall be removed and reinstalled or remedial action performed as directed at no additional cost to the Government.
  2. The term "conveniently accessible" is defined as capable of being reached without the use of ladders, or without climbing or crawling under or over obstacles such as motors, fans, pumps, belt guards, transformers, high voltage lines, piping, and ductwork.

**3.2 TEMPORARY PIPING AND EQUIPMENT**

- A. Continuity of operation of existing facilities will generally require temporary installation or relocation of equipment and piping.
- B. The Contractor shall provide all required facilities in accordance with the requirements of phased construction and maintenance of service. All piping and equipment shall be properly supported, sloped to drain, operate without excessive stress, and shall be insulated where injury can occur to personnel by contact with operating facilities. The requirements of Paragraph 3.1 apply.

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- C. Temporary facilities and piping shall be completely removed and any openings in structures sealed. Provide necessary blind flanges and caps to seal open piping remaining in service.

**3.3 RIGGING**

- A. Design is based on application of available equipment. Openings in building structures are planned to accommodate design scheme.
- B. Alternative methods of equipment delivery may be offered by Contractor and will be considered by Government under specified restrictions of phasing and maintenance of service as well as structural integrity of the building.
- C. Close all openings in the building when not required for rigging operations to maintain proper environment in the facility for Government operation and maintenance of service.
- D. Contractor shall provide all facilities required to deliver specified equipment and place on foundations. Attachments to structures for rigging purposes and support of equipment on structures shall be Contractor's full responsibility. Upon request, the Government will check structure adequacy and advise Contractor of recommended restrictions.
- E. Contractor shall check all clearances, weight limitations and shall offer a rigging plan designed by a Registered Professional Engineer. All modifications to structures, including reinforcement thereof, shall be at Contractor's cost, time and responsibility.
- F. Rigging plan and methods shall be referred to Resident Engineer for evaluation prior to actual work.
- G. Restore building to original condition upon completion of rigging work.

**3.4 PIPE AND EQUIPMENT SUPPORTS**

- A. Where hanger spacing does not correspond with joist or rib spacing, use structural steel channels secured directly to joist and rib structure that will correspond to the required hanger spacing, and then suspend the equipment and piping from the channels. Drill or burn holes in structural steel only with the prior approval of the Resident Engineer.
- B. Use of chain, wire or strap hangers; wood for blocking, stays and bracing; or, hangers suspended from piping above will not be permitted. Replace or thoroughly clean rusty products and paint with zinc primer.
- C. Use hanger rods that are straight and vertical. Turnbuckles for vertical adjustments may be omitted where limited space prevents use. Provide a minimum of 15 mm (1/2-inch) clearance between pipe or piping covering and adjacent work.

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- D. HVAC Horizontal Pipe Support Spacing: Refer to MSS SP-69. Provide additional supports at valves, strainers, in-line pumps and other heavy components. Provide a support within one foot of each elbow.
- E. HVAC Vertical Pipe Supports:
  - 1. Up to 150 mm (6-inch pipe), 9 m (30 feet) long, bolt riser clamps to the pipe below couplings, or welded to the pipe and rests supports securely on the building structure.
  - 2. Vertical pipe larger than the foregoing, support on base elbows or tees, or substantial pipe legs extending to the building structure.
- F. Overhead Supports:
  - 1. The basic structural system of the building is designed to sustain the loads imposed by equipment and piping to be supported overhead.
  - 2. Provide steel structural members, in addition to those shown, of adequate capability to support the imposed loads, located in accordance with the final approved layout of equipment and piping.
  - 3. Tubing and capillary systems shall be supported in channel troughs.
- G. Floor Supports:
  - 1. Provide concrete bases, concrete anchor blocks and pedestals, and structural steel systems for support of equipment and piping. Anchor and dowel concrete bases and structural systems to resist forces under operating and seismic conditions (if applicable) without excessive displacement or structural failure.
  - 2. Do not locate or install bases and supports until equipment mounted thereon has been approved. Size bases to match equipment mounted thereon plus 50 mm (2 inch) excess on all edges. Boiler foundations shall have horizontal dimensions that exceed boiler base frame dimensions by at least 150 mm (6 inches) on all sides. Refer to structural drawings. Bases shall be neatly finished and smoothed, shall have chamfered edges at the top, and shall be suitable for painting.
  - 3. All equipment shall be shimmed, leveled, firmly anchored, and grouted with epoxy grout. Anchor bolts shall be placed in sleeves, anchored to the bases. Fill the annular space between sleeves and bolts with a granular material to permit alignment and realignment.
  - 4. For seismic anchoring, refer to Section 13 05 41, SEISMIC RESTRAINT REQUIREMENTS FOR NON-STRUCTURAL COMPONENTS.

**3.5 MECHANICAL DEMOLITION**

- A. Rigging access, other than indicated on the drawings, shall be provided by the Contractor after approval for structural integrity by the Resident Engineer. Such access shall be provided without additional cost

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or time to the Government. Where work is in an operating plant, provide approved protection from dust and debris at all times for the safety of plant personnel and maintenance of plant operation and environment of the plant.

- B. In an operating facility, maintain the operation, cleanliness and safety. Government personnel will be carrying on their normal duties of operating, cleaning and maintaining equipment and plant operation. Confine the work to the immediate area concerned; maintain cleanliness and wet down demolished materials to eliminate dust. Do not permit debris to accumulate in the area to the detriment of plant operation. Perform all flame cutting to maintain the fire safety integrity of this plant. Adequate fire extinguishing facilities shall be available at all times. Perform all work in accordance with recognized fire protection standards. Inspection will be made by personnel of the VA Medical Center, and Contractor shall follow all directives of the RE or COTR with regard to rigging, safety, fire safety, and maintenance of operations.
- C. Completely remove all piping, wiring, conduit, and other devices associated with the equipment not to be re-used in the new work. This includes all pipe, valves, fittings, insulation, and all hangers including the top connection and any fastenings to building structural systems. Seal all openings, after removal of equipment, pipes, ducts, and other penetrations in roof, walls, floors, in an approved manner and in accordance with plans and specifications where specifically covered. Structural integrity of the building system shall be maintained. Reference shall also be made to the drawings and specifications of the other disciplines in the project for additional facilities to be demolished or handled.
- D. All valves including gate, globe, ball, butterfly and check, all pressure gages and thermometers with wells shall remain Government property and shall be removed and delivered to Resident Engineer and stored as directed. The Contractor shall remove all other material and equipment, devices and demolition debris under these plans and specifications. Such material shall be removed from Government property expeditiously and shall not be allowed to accumulate.
- E. Asbestos Insulation Removal: Conform to Section 02 82 11, TRADITIONAL ASBESTOS ABATEMENT.

**3.6 CLEANING AND PAINTING**

- A. Prior to final inspection and acceptance of the plant and facilities for beneficial use by the Government, the plant facilities, equipment and

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systems shall be thoroughly cleaned and painted. Refer to Section 09 91 00, PAINTING.

B. In addition, the following special conditions apply:

1. Cleaning shall be thorough. Use solvents, cleaning materials and methods recommended by the manufacturers for the specific tasks. Remove all rust prior to painting and from surfaces to remain unpainted. Repair scratches, scuffs, and abrasions prior to applying prime and finish coats.
2. Material And Equipment Not To Be Painted Includes:
  - a. Motors, controllers, control switches, and safety switches.
  - b. Control and interlock devices.
  - c. Regulators.
  - d. Pressure reducing valves.
  - e. Control valves and thermostatic elements.
  - f. Lubrication devices and grease fittings.
  - g. Copper, brass, aluminum, stainless steel and bronze surfaces.
  - h. Valve stems and rotating shafts.
  - i. Pressure gauges and thermometers.
  - j. Glass.
  - k. Name plates.
3. Control and instrument panels shall be cleaned, damaged surfaces repaired, and shall be touched-up with matching paint obtained from panel manufacturer.
4. Pumps, motors, steel and cast iron bases, and coupling guards shall be cleaned, and shall be touched-up with the same color as utilized by the pump manufacturer
5. Temporary Facilities: Apply paint to surfaces that do not have existing finish coats.
6. Paint shall withstand the following temperatures without peeling or discoloration:
  - a. Condensate and feedwater -- 38 degrees C (100 degrees F) on insulation jacket surface and 120 degrees C (250 degrees F) on metal pipe surface.
  - b. Steam -- 52 degrees C (125 degrees F) on insulation jacket surface and 190 degrees C (375 degrees F) on metal pipe surface.
7. Final result shall be smooth, even-colored, even-textured factory finish on all items. Completely repaint the entire piece of equipment if necessary to achieve this.

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**3.7 IDENTIFICATION SIGNS**

- A. Provide laminated plastic signs, with engraved lettering not less than 5 mm (3/16-inch) high, designating functions, for all equipment, switches, motor controllers, relays, meters, control devices, including automatic control valves. Nomenclature and identification symbols shall correspond to that used in maintenance manual, and in diagrams specified elsewhere. Attach by chain, adhesive, or screws.
- B. Factory Built Equipment: Metal plate, securely attached, with name and address of manufacturer, serial number, model number, size, performance.
- C. Pipe Identification: Refer to Section 09 91 00, PAINTING.

**3.8 MOTOR AND DRIVE ALIGNMENT**

- A. Belt Drive: Set driving and driven shafts parallel and align so that the corresponding grooves are in the same plane.
- B. Direct-connect Drive: Securely mount motor in accurate alignment so that shafts are free from both angular and parallel misalignment when both motor and driven machine are operating at normal temperatures.

**3.9 LUBRICATION**

- A. Lubricate all devices requiring lubrication prior to initial operation. Field-check all devices for proper lubrication.
- B. Equip all devices with required lubrication fittings or devices. Provide a minimum of one liter (one quart) of oil and 0.5 kg (one pound) of grease of manufacturer's recommended grade and type for each different application; also provide 12 grease sticks for lubricated plug valves. Deliver all materials to Resident Engineer in unopened containers that are properly identified as to application.
- C. Provide a separate grease gun with attachments for applicable fittings for each type of grease applied.
- D. All lubrication points shall be accessible without disassembling equipment, except to remove access plates.

**3.10 STARTUP AND TEMPORARY OPERATION**

Start up equipment as described in equipment specifications. Verify that vibration is within specified tolerance prior to extended operation. Temporary use of equipment is specified in Section 01 00 00, GENERAL REQUIREMENTS, Article, TEMPORARY USE OF MECHANICAL AND ELECTRICAL EQUIPMENT.

**3.11 OPERATING AND PERFORMANCE TESTS**

- A. Prior to the final inspection, perform required tests as specified in Section 01 00 00, GENERAL REQUIREMENTS and submit the test reports and records to the Resident Engineer.

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- B. Should evidence of malfunction in any tested system, or piece of equipment or component part thereof, occur during or as a result of tests, make proper corrections, repairs or replacements, and repeat tests at no additional cost to the Government.
- C. When completion of certain work or system occurs at a time when final control settings and adjustments cannot be properly made to make performance tests, then make performance tests for heating systems and for cooling systems respectively during first actual seasonal use of respective systems following completion of work.

**3.12 INSTRUCTIONS TO VA PERSONNEL**

Provide in accordance with Article, INSTRUCTIONS, of Section 01 00 00, GENERAL REQUIREMENTS, and Section 23 08 11, DEMONSTRATIONS AND TESTS FOR BOILER PLANT.

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SECTION 23 05 12  
GENERAL MOTOR REQUIREMENTS FOR HVAC AND STEAM GENERATION EQUIPMENT

PART 1 - GENERAL

1.1 DESCRIPTION:

This section specifies the furnishing, installation and connection of motors for HVAC and steam generation equipment.

1.2 RELATED WORK:

- A. Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS: General electrical requirements common to more than one Section of Division 26.
- B. Section 26 29 11, LOW-VOLTAGE MOTOR STARTERS: Starters, control and protection for motors.
- D. Section 23 05 11, COMMON WORK RESULTS FOR HVAC.
- F. Section 23 21 23, HYDRONIC PUMPS.
- G. Section 23 34 00, HVAC FANS.
- H. Section 23 36 00, AIR TERMINAL UNITS.
- I. Section 23 73 00, INDOOR CENTRAL-STATION AIR-HANDLING UNITS.
- J. Section 23 81 00, DECENTRALIZED UNITARY HVAC EQUIPMENT.
- K. Section 23 82 00, CONVECTION HEATING and COOLING UNITS.

1.3 SUBMITTALS:

- A. In accordance with Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS, submit the following:
- B. Shop Drawings:
  - 1. Provide documentation to demonstrate compliance with drawings and specifications.
  - 2. Include electrical ratings, efficiency, bearing data, power factor, frame size, dimensions, mounting details, materials, horsepower, voltage, phase, speed (RPM), enclosure, starting characteristics, torque characteristics, code letter, full load and locked rotor current, service factor, and lubrication method.
- C. Manuals:
  - 1. Submit simultaneously with the shop drawings, companion copies of complete installation, maintenance and operating manuals, including technical data sheets and application data.
- D. Certification: Two weeks prior to final inspection, unless otherwise noted, submit four copies of the following certification to the Resident Engineer:
  - 1. Certification that the motors have been applied, installed, adjusted, lubricated, and tested according to manufacturer published recommendations.

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- E. Completed System Readiness Checklists provided by the Commissioning Agent and completed by the contractor, signed by a qualified technician and dated on the date of completion, in accordance with the requirements.

**1.4 APPLICABLE PUBLICATIONS:**

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.
- B. National Electrical Manufacturers Association (NEMA):
  - MG 1-2006 Rev. 1 2009 .Motors and Generators
  - MG 2-2001 Rev. 1 2007 ..Safety Standard for Construction and Guide for Selection, Installation and Use of Electric Motors and Generators
- C. National Fire Protection Association (NFPA):
  - 70-2008 .....National Electrical Code (NEC)
- D. Institute of Electrical and Electronics Engineers (IEEE):
  - 112-04 .....Standard Test Procedure for Polyphase Induction Motors and Generators
- E. American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE):
  - 90.1-2007 .....Energy Standard for Buildings Except Low-Rise Residential Buildings

**PART 2 - PRODUCTS**

**2.1 MOTORS:**

- A. For alternating current, fractional and integral horsepower motors, NEMA Publications MG 1 and MG 2 shall apply.
- B. All material and equipment furnished and installation methods shall conform to the requirements of Section 26 29 11, LOW-VOLTAGE MOTOR STARTERS; and Section 26 05 19, LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES (600 VOLTS AND BELOW). Provide all electrical wiring, conduit, and devices necessary for the proper connection, protection and operation of the systems. Provide premium efficiency type motors as scheduled. Unless otherwise specified for a particular application, use electric motors with the following requirements.
- C. Single-phase Motors: Motors for centrifugal fans and pumps may be split phase or permanent split capacitor (PSC) type. Provide capacitor-start type for hard starting applications.
  - 1. Contractor's Option - Electrically Commutated motor (EC Type): Motor shall be brushless DC type specifically designed for applications with heavy duty ball bearings and electronic commutation. The motor

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shall be speed controllable down to 20% of full speed and 85% efficient at all speeds.

- D. Poly-phase Motors: NEMA Design B, Squirrel cage, induction type.
  - 1. Two Speed Motors: Each two-speed motor shall have two separate windings. Provide a time- delay (20 seconds minimum) relay for switching from high to low speed.
- E. Voltage ratings shall be as follows:
  - 1. Single phase:
    - a. Motors connected to 120-volt systems: 115 volts.
    - b. Motors connected to 208-volt systems: 200 volts.
    - c. Motors connected to 240 volt or 480 volt systems: 230/460 volts, dual connection.
  - 2. Three phase:
    - a. Motors connected to 208-volt systems: 200 volts.
    - b. Motors, less than 74.6 kW (100 HP), connected to 240 volt or 480 volt systems: 208-230/460 volts, dual connection.
    - c. Motors, 74.6 kW (100 HP) or larger, connected to 240-volt systems: 230 volts.
    - d. Motors, 74.6 kW (100 HP) or larger, connected to 480-volt systems: 460 volts.
    - e. Motors connected to high voltage systems (Over 600V): Shall conform to NEMA Standards for connection to the nominal system voltage shown on the drawings.
- F. Number of phases shall be as follows:
  - 1. Motors, less than 373 W (1/2 HP): Single phase.
  - 2. Motors, 373 W (1/2 HP) and larger: 3 phase.
  - 3. Exceptions:
    - a. Hermetically sealed motors.
    - b. Motors for equipment assemblies, less than 746 W (one HP), may be single phase provided the manufacturer of the proposed assemblies cannot supply the assemblies with three phase motors.
- G. Motors shall be designed for operating the connected loads continuously in a 40°C (104°F) environment, where the motors are installed, without exceeding the NEMA standard temperature rises for the motor insulation. If the motors exceed 40°C (104°F), the motors shall be rated for the actual ambient temperatures.
- H. Motor designs, as indicated by the NEMA code letters, shall be coordinated with the connected loads to assure adequate starting and running torque.
- I. Motor Enclosures:

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1. Shall be the NEMA types as specified and/or shown on the drawings.
2. Where the types of motor enclosures are not shown on the drawings, they shall be the NEMA types, which are most suitable for the environmental conditions where the motors are being installed. Enclosure requirements for certain conditions are as follows:
  - a. Motors located outdoors, indoors in wet or high humidity locations, or in unfiltered airstreams shall be totally enclosed type.
  - b. Where motors are located in an NEC 511 classified area, provide TEFC explosion proof motor enclosures.
  - c. Where motors are located in a corrosive environment, provide TEFC enclosures with corrosion resistant finish.
3. Enclosures shall be primed and finish coated at the factory with manufacturer's prime coat and standard finish.

**J. Special Requirements:**

1. Where motor power requirements of equipment furnished deviate from power shown on plans, provide electrical service designed under the requirements of NFPA 70 without additional time or cost to the Government.
2. Assemblies of motors, starters, controls and interlocks on factory assembled and wired devices shall be in accordance with the requirements of this specification.
3. Wire and cable materials specified in the electrical division of the specifications shall be modified as follows:
  - a. Wiring material located where temperatures can exceed 71 degrees C (160 degrees F) shall be stranded copper with Teflon FEP insulation with jacket. This includes wiring on the boilers.
  - b. Other wiring at boilers and to control panels shall be NFPA 70 designation THWN.
  - c. Provide shielded conductors or wiring in separate conduits for all instrumentation and control systems where recommended by manufacturer of equipment.
4. Select motor sizes so that the motors do not operate into the service factor at maximum required loads on the driven equipment. Motors on pumps shall be sized for non-overloading at all points on the pump performance curves.
5. Motors utilized with variable frequency drives shall be rated "inverter-duty" per NEMA Standard, MG1, Part 31.4.4.2. Provide motor shaft grounding apparatus that will protect bearings from damage from stray currents.

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K. Additional requirements for specific motors, as indicated in the other sections listed in Article 1.2, shall also apply.

L. Energy-Efficient Motors (Motor Efficiencies): All permanently wired polyphase motors of 746 Watts (1 HP) or more shall meet the minimum full-load efficiencies as indicated in the following table. Motors of 746 Watts or more with open, drip-proof or totally enclosed fan-cooled enclosures shall be NEMA premium efficiency type, unless otherwise indicated. Motors provided as an integral part of motor driven equipment are excluded from this requirement if a minimum seasonal or overall efficiency requirement is indicated for that equipment by the provisions of another section. Motors not specified as "premium efficiency" shall comply with the Energy Policy Act of 2005 (EPACT).

Minimum Premium Efficiencies Open Drip-Proof				Minimum Premium Efficiencies Totally Enclosed Fan-Cooled			
Rating kW (HP)	1200 RPM	1800 RPM	3600 RPM	Rating kW (HP)	1200 RPM	1800 RPM	3600 RPM
0.746 (1)	82.5%	85.5%	77.0%	0.746 (1)	82.5%	85.5%	77.0%
1.12 (1.5)	86.5%	86.5%	84.0%	1.12 (1.5)	87.5%	86.5%	84.0%
1.49 (2)	87.5%	86.5%	85.5%	1.49 (2)	88.5%	86.5%	85.5%
2.24 (3)	88.5%	89.5%	85.5%	2.24 (3)	89.5%	89.5%	86.5%
3.73 (5)	89.5%	89.5%	86.5%	3.73 (5)	89.5%	89.5%	88.5%
5.60 (7.5)	90.2%	91.0%	88.5%	5.60 (7.5)	91.0%	91.7%	89.5%
7.46 (10)	91.7%	91.7%	89.5%	7.46 (10)	91.0%	91.7%	90.2%
11.2 (15)	91.7%	93.0%	90.2%	11.2 (15)	91.7%	92.4%	91.0%
14.9 (20)	92.4%	93.0%	91.0%	14.9 (20)	91.7%	93.0%	91.0%
18.7 (25)	93.0%	93.6%	91.7%	18.7 (25)	93.0%	93.6%	91.7%
22.4 (30)	93.6%	94.1%	91.7%	22.4 (30)	93.0%	93.6%	91.7%
29.8 (40)	94.1%	94.1%	92.4%	29.8 (40)	94.1%	94.1%	92.4%
37.3 (50)	94.1%	94.5%	93.0%	37.3 (50)	94.1%	94.5%	93.0%
44.8 (60)	94.5%	95.0%	93.6%	44.8 (60)	94.5%	95.0%	93.6%
56.9 (75)	94.5%	95.0%	93.6%	56.9 (75)	94.5%	95.4%	93.6%
74.6 (100)	95.0%	95.4%	93.6%	74.6 (100)	95.0%	95.4%	94.1%
93.3 (125)	95.0%	95.4%	94.1%	93.3 (125)	95.0%	95.4%	95.0%
112 (150)	95.4%	95.8%	94.1%	112 (150)	95.8%	95.8%	95.0%
149.2 (200)	95.4%	95.8%	95.0%	149.2 (200)	95.8%	96.2%	95.4%

M. Minimum Power Factor at Full Load and Rated Voltage: 90 percent at 1200 RPM, 1800 RPM and 3600 RPM.

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**PART 3 - EXECUTION**

**3.1 INSTALLATION:**

Install motors in accordance with manufacturer's recommendations, the NEC, NEMA, as shown on the drawings and/or as required by other sections of these specifications.

**3.2 FIELD TESTS**

- A. Perform an electric insulation resistance Test using a megohmmeter on all motors after installation, before start-up. All shall test free from grounds.
- B. Perform Load test in accordance with ANSI/IEEE 112, Test Method B, to determine freedom from electrical or mechanical defects and compliance with performance data.
- C. Insulation Resistance: Not less than one-half meg-ohm between stator conductors and frame, to be determined at the time of final inspection.

**3.3 STARTUP AND TESTING**

- A. The Commissioning Agent will observe startup and contractor testing of selected equipment. Coordinate the startup and contractor testing schedules with Resident Engineer and Commissioning Agent. Provide a minimum of 7 days prior notice.

**3.4 COMMISSIONING**

- A. Provide commissioning documentation in accordance with the requirements for all inspection, start up, and contractor testing required above and required by the System Readiness Checklist provided by the Commissioning Agent.
- B. Components provided under this section of the specification will be tested as part of a larger system.

**3.5 DEMONSTRATION AND TRAINING**

- A. Provide services of manufacturer's technical representative for four hours to instruct VA personnel in operation and maintenance of units.
- B. Submit training plans and instructor qualifications in accordance with the requirements.

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SECTION 23 05 41  
NOISE AND VIBRATION CONTROL FOR HVAC PIPING AND EQUIPMENT

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

Noise criteria, seismic restraints for equipment, vibration tolerance and vibration isolation for HVAC and plumbing work.

**1.2 RELATED WORK**

- A. Section 03 30 00, CAST-IN-PLACE CONCRETE: Requirements for concrete inertia bases.
- B. Section 13 05 41, SEISMIC RESTRAINT REQUIREMENTS FOR NON-STRUCTURAL COMPONENTS: Seismic requirements for non-structural equipment
- C. Section 23 05 11, COMMON WORK RESULTS FOR HVAC and STEAM GENERATION: General mechanical requirements and items, which are common to more than one section of Division 23.
- D. Section 23 22 13, STEAM and CONDENSATE HEATING PIPING: Requirements for flexible pipe connectors to reciprocating and rotating mechanical equipment.
- E. Section 23 73 00, INDOOR CENTRAL-STATION AIR-HANDLING UNITS: Requirements for optional Air Handling Unit internal vibration isolation.
- F. Section 23 31 00, HVAC DUCTS and CASINGS: requirements for flexible duct connectors, sound attenuators and sound absorbing duct lining.
- G. SECTION 23 05 93, TESTING, ADJUSTING, and BALANCING FOR HVAC: requirements for sound and vibration tests.
- H. SECTION 23 37 00, AIR OUTLETS and INLETS: noise requirements for G-grilles.
- I. SECTION 23 21 23, HYDRONIC PUMPS: vibration isolation requirements for pumps.
- J. SECTION 23 34 00, HVAC FANS: sound and vibration isolation requirements for fans.
- K. Section 23 08 00, COMMISSIONING OF HVAC SYSTEMS: Requirements for commissioning, systems readiness checklists, and training.

**1.3 QUALITY ASSURANCE**

- A. Refer to article, QUALITY ASSURANCE in specification Section 23 05 11, COMMON WORK RESULTS FOR HVAC and STEAM GENERATION.

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**B. Noise Criteria:**

1. Noise levels in all 8 octave bands due to equipment and duct systems shall not exceed following NC levels:

<b>TYPE OF ROOM</b>	<b>NC LEVEL</b>
Bathrooms and Toilet Rooms	40
Conference Rooms	35
Corridors (Nurse Stations)	40
Corridors(Public)	40
Dining Rooms, Food Services/ Serving	40
Examination Rooms	35
Lobbies, Waiting Areas	40
Locker Rooms	45
Offices, Large Open	40
Offices, Small Private	35
Patient Rooms	35
Phono/Cardiology	25
Recreation Rooms	40-45
SPD (Decontamination and Clean Preparation)	45
Treatment Rooms	35
X-Ray and General Work Rooms	40

2. For equipment which has no sound power ratings scheduled on the plans, the contractor shall select equipment such that the foregoing noise criteria, local ordinance noise levels, and OSHA requirements are not exceeded. Selection procedure shall be in accordance with ASHRAE Fundamentals Handbook, Chapter 7, Sound and Vibration.
3. An allowance, not to exceed 5db, may be added to the measured value to compensate for the variation of the room attenuating effect between room test condition prior to occupancy and design condition after occupancy which may include the addition of sound absorbing material, such as, furniture. This allowance may not be taken after occupancy. The room attenuating effect is defined as the difference between sound power level emitted to room and sound pressure level in room.



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4. In absence of specified measurement requirements, measure equipment noise levels three feet from equipment and at an elevation of maximum noise generation.

**C. Seismic Restraint Requirements:**

**1. Equipment:**

- a. All mechanical equipment not supported with isolators external to the unit shall be securely anchored to the structure. Such mechanical equipment shall be properly supported to resist a horizontal force of 50 percent of the weight of the equipment furnished.
- b. All mechanical equipment mounted on vibration isolators shall be provided with seismic restraints capable of resisting a horizontal force of 100 percent of the weight of the equipment furnished.

2. Piping: Refer to specification Section 23 05 11, COMMON WORK RESULTS FOR HVAC and STEAM GENERATION.

3. Ductwork: Refer to specification Section 23 31 00, HVAC DUCTS AND CASINGS.

- D. Allowable Vibration Tolerances for Rotating, Non-reciprocating Equipment:** Not to exceed a self-excited vibration maximum velocity of 5 mm per second (0.20 inch per second) RMS, filter in, when measured with a vibration meter on bearing caps of machine in vertical, horizontal and axial directions or measured at equipment mounting feet if bearings are concealed. Measurements for internally isolated fans and motors may be made at the mounting feet.

**1.4 SUBMITTALS**

- A.** Submit in accordance with specification Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, and SAMPLES.

**B. Manufacturer's Literature and Data:**

**1. Vibration isolators:**

- a. Floor mountings
- b. Hangers
- c. Snubbers
- d. Thrust restraints

**2. Bases.**

3. Seismic restraint provisions and bolting.

4. Acoustical enclosures.

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- C. Isolator manufacturer shall furnish with submittal load calculations for selection of isolators, including supplemental bases, based on lowest operating speed of equipment supported.
- D. Seismic Requirements: Submittals are required for all equipment anchors, supports and seismic restraints. Submittals shall include weights, dimensions, standard connections, and manufacturer's certification that all specified equipment will withstand seismic Lateral Force requirements as shown on drawings.

**1.5 APPLICABLE PUBLICATIONS**

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.
- B. American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc. (ASHRAE):
  - 2009 .....Fundamentals Handbook, Chapter 7, Sound and Vibration
- C. American Society for Testing and Materials (ASTM):
  - A123/A123M-09 .....Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
  - A307-07b .....Standard Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength
  - D2240-05(2010) .....Standard Test Method for Rubber Property - Durometer Hardness
- D. Manufacturers Standardization (MSS):
  - SP-58-2009 .....Pipe Hangers and Supports-Materials, Design and Manufacture
- E. Occupational Safety and Health Administration (OSHA):
  - 29 CFR 1910.95 .....Occupational Noise Exposure
- F. American Society of Civil Engineers (ASCE):
  - ASCE 7-10 .....Minimum Design Loads for Buildings and Other Structures.
- G. American National Standards Institute / Sheet Metal and Air Conditioning Contractor's National Association (ANSI/SMACNA):
  - 001-2008 .....Seismic Restraint Manual: Guidelines for Mechanical Systems, 3rd Edition.
- H. International Code Council (ICC):
  - 2009 IBC .....International Building Code.

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I. Department of Veterans Affairs (VA):

H-18-8 2010 .....Seismic Design Requirements.

**PART 2 - PRODUCTS**

**2.1 GENERAL REQUIREMENTS**

- A. Type of isolator, base, and minimum static deflection shall be as required for each specific equipment application as recommended by isolator or equipment manufacturer but subject to minimum requirements indicated herein and in the schedule on the drawings.
- B. Elastometric Isolators shall comply with ASTM D2240 and be oil resistant neoprene with a maximum stiffness of 60 durometer and have a straight-line deflection curve.
- C. Exposure to weather: Isolator housings to be either hot dipped galvanized or powder coated to ASTM B117 salt spray testing standards. Springs to be powder coated or electro galvanized. All hardware to be electro galvanized. In addition provide limit stops to resist wind velocity. Velocity pressure established by wind shall be calculated in accordance with section 1609 of the International Building Code. A minimum wind velocity of 75 mph shall be employed.
- D. Uniform Loading: Select and locate isolators to produce uniform loading and deflection even when equipment weight is not evenly distributed.
- E. Color code isolators by type and size for easy identification of capacity.

**2.2 SEISMIC RESTRAINT REQUIREMENTS FOR EQUIPMENTS**

- A. Bolt pad mounted equipment, without vibration isolators, to the floor or other support using ASTM A307 standard bolting material.
- B. Floor mounted equipment, with vibration Isolators: Type SS. Where Type N isolators are used provide channel frame base horizontal restraints bolted to the floor, or other support, on all sides of the equipment. Size and material required for the base shall be as recommended by the isolator manufacturer.
- C. On all sides of suspended equipment, provide bracing for rigid supports and provide restraints for resiliently supported equipment.

**2.3 VIBRATION ISOLATORS**

- A. Floor Mountings:
  - 1. Double Deflection Neoprene (Type N): Shall include neoprene covered steel support plated (top and bottom), friction pads, and necessary bolt holes.

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2. Captive Spring Mount for Seismic Restraint (Type SS):
    - a. Design mounts to resiliently resist seismic forces in all directions. Snubbing shall take place in all modes with adjustment to limit upward, downward, and horizontal travel to a maximum of 6 mm (1/4-inch) before contacting snubbers. Mountings shall have a minimum rating of one G coefficient of gravity as calculated and certified by a registered structural engineer.
    - b. All mountings shall have leveling bolts that must be rigidly bolted to the equipment. Spring diameters shall be no less than 0.8 of the compressed height of the spring at rated load. Springs shall have a minimum additional travel to solid equal to 50 percent of the rated deflection. Mountings shall have ports for spring inspection. Provide an all directional neoprene cushion collar around the equipment bolt.
  3. Spring Isolators with Vertical Limit Stops (Type SP): Similar to spring isolators noted above, except include a vertical limit stop to limit upward travel if weight is removed and also to reduce movement and spring extension due to wind loads. Provide clearance around restraining bolts to prevent mechanical short circuiting. // Isolators shall have a minimum seismic rating of one G. //
  - . 4. Seismic Pad (Type DS): Pads shall be natural rubber / neoprene waffle with steel top plate and drilled for an anchor bolt. Washers and bushings shall be reinforced duck and neoprene. Size pads for a maximum load of 345 kPa (50 pounds per square inch).
- B. Hangers: Shall be combination neoprene and springs unless otherwise noted and shall allow for expansion of pipe.
1. Combination Neoprene and Spring (Type H): Vibration hanger shall contain a spring and double deflection neoprene element in series. Spring shall have a diameter not less than 0.8 of compressed operating spring height. Spring shall have a minimum additional travel of 50 percent between design height and solid height. Spring shall permit a 15 degree angular misalignment without rubbing on hanger box.
  2. Spring Position Hanger (Type HP): Similar to combination neoprene and spring hanger except hanger shall hold piping at a fixed elevation during installation and include a secondary adjustment feature to transfer load to spring while maintaining same position.

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3. Neoprene (Type HN): Vibration hanger shall contain a double deflection type neoprene isolation element. Hanger rod shall be separated from contact with hanger bracket by a neoprene grommet.
  4. Spring (Type HS): Vibration hanger shall contain a coiled steel spring in series with a neoprene grommet. Spring shall have a diameter not less than 0.8 of compressed operating spring height. Spring shall have a minimum additional travel of 50 percent between design height and solid height. Spring shall permit a 15 degree angular misalignment without rubbing on hanger box.
  5. Hanger supports for piping 50 mm (2 inches) and larger shall have a pointer and scale deflection indicator.
  6. Hangers used in seismic applications shall be provided with a neoprene and steel rebound washer installed  $\frac{1}{4}$ ' clear of bottom of hanger housing in operation to prevent spring from excessive upward travel
- C. Snubbers: Each spring mounted base shall have a minimum of four all-directional or eight two directional (two per side) seismic snubbers that are double acting. Elastomeric materials shall be shock absorbent neoprene bridge quality bearing pads, maximum 60 durometer, replaceable and have a minimum thickness of 6 mm (1/4 inch). Air gap between hard and resilient material shall be not less than 3 mm (1/8 inch) nor more than 6 mm (1/4 inch). Restraints shall be capable of withstanding design load without permanent deformation.
- D. Thrust Restraints (Type THR): Restraints shall provide a spring element contained in a steel frame with neoprene pads at each end attachment. Restraints shall have factory preset thrust and be field adjustable to allow a maximum movement of 6 mm (1/4 inch) when the fan starts and stops. Restraint assemblies shall include rods, angle brackets and other hardware for field installation.

#### **2.4 BASES**

- A. Rails (Type R): Design rails with isolator brackets to reduce mounting height of equipment and cradle machines having legs or bases that do not require a complete supplementary base. To assure adequate stiffness, height of members shall be a minimum of 1/12 of longest base dimension but not less than 100 mm (4 inches). Where rails are used with neoprene mounts for small fans or close coupled pumps, extend rails to compensate overhang of housing.

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- B. Integral Structural Steel Base (Type B): Design base with isolator brackets to reduce mounting height of equipment which require a complete supplementary rigid base. To assure adequate stiffness, height of members shall be a minimum of 1/12 of longest base dimension, but not less than 100 mm (four inches).
- C. Inertia Base (Type I): Base shall be a reinforced concrete inertia base. Pour concrete into a welded steel channel frame, incorporating prelocated equipment anchor bolts and pipe sleeves. Level the concrete to provide a smooth uniform bearing surface for equipment mounting. Provide grout under uneven supports. Channel depth shall be a minimum of 1/12 of longest dimension of base but not less than 150 mm (six inches). Form shall include 13-mm (1/2-inch) reinforcing bars welded in place on minimum of 203 mm (eight inch) centers running both ways in a layer 40 mm (1-1/2 inches) above bottom. Use height saving brackets in all mounting locations. Weight of inertia base shall be equal to or greater than weight of equipment supported to provide a maximum peak-to-peak displacement of 2 mm (1/16 inch).

**2.5 SOUND ATTENUATING UNITS**

Refer to specification Section 23 31 00, HVAC DUCTS and CASINGS.

**PART 3 - EXECUTION**

**3.1 INSTALLATION**

- A. Vibration Isolation:
  - 1. No metal-to-metal contact will be permitted between fixed and floating parts.
  - 2. Connections to Equipment: Allow for deflections equal to or greater than equipment deflections. Electrical, drain, piping connections, and other items made to rotating or reciprocating equipment (pumps, compressors, etc.) which rests on vibration isolators, shall be isolated from building structure for first three hangers or supports with a deflection equal to that used on the corresponding equipment.
  - 3. Common Foundation: Mount each electric motor on same foundation as driven machine. Hold driving motor and driven machine in positive rigid alignment with provision for adjusting motor alignment and belt tension. Bases shall be level throughout length and width. Provide shims to facilitate pipe connections, leveling, and bolting.
  - 4. Provide heat shields where elastomers are subject to temperatures over 38 degrees C (100 degrees F).

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5. Extend bases for pipe elbow supports at discharge and suction connections at pumps. Pipe elbow supports shall not short circuit pump vibration to structure.
  6. Non-rotating equipment such as heat exchangers and convertors shall be mounted on isolation units having the same static deflection as the isolation hangers or support of the pipe connected to the equipment.
- B. Inspection and Adjustments: Check for vibration and noise transmission through connections, piping, ductwork, foundations, and walls. Adjust, repair, or replace isolators as required to reduce vibration and noise transmissions to specified levels.

**3.2 ADJUSTING**

- A. Adjust vibration isolators after piping systems are filled and equipment is at operating weight.
- B. Adjust limit stops on restrained spring isolators to mount equipment at normal operating height. After equipment installation is complete, adjust limit stops so they are out of contact during normal operation.
- C. Attach thrust limits at centerline of thrust and adjust to a maximum of 1/4inch (6-mm) movement during start and stop.
- D. Adjust active height of spring isolators.
- E. Adjust snubbers according to manufacturer's recommendations.
- F. Adjust seismic restraints to permit free movement of equipment within normal mode of operation.
- G. Torque anchor bolts according to equipment manufacturer's recommendations to resist seismic forces.

**3.3 COMMISSIONING**

- A. Provide commissioning documentation in accordance with the requirements of section 23 08 00 - COMMISSIONING OF HVAC SYSTEMS for all inspection, start up, and contractor testing required above and required by the System Readiness Checklist provided by the Commissioning Agent.
- B. Components provided under this section of the specification will be tested as part of a larger system. Refer to section 23 08 00 - COMMISSIONING OF HVAC SYSTEMS and related sections for contractor responsibilities for system commissioning.

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SELECTION GUIDE FOR VIBRATION ISOLATORS

EQUIPMENT		ON GRADE			20FT FLOOR SPAN			30FT FLOOR SPAN			40FT FLOOR SPAN			50FT FLOOR SPAN		
		BASE TYPE	ISOL TYPE	MIN DEFL	BASE TYPE	ISOL TYPE	MIN DEFL	BASE TYPE	ISOL TYPE	MIN DEFL	BASE TYPE	ISOL TYPE	MIN DEFL	BASE TYPE	ISOL TYPE	MIN DEFL
<b>PUMPS</b>																
CLOSE COUPLED	UP TO 1-1/2 HP	---	---	---	---	D,L, W	---	---	D,L, W	---	---	D,L, W	---	---	D,L, W	---
	2 HP & OVER	---	---	---	I	S	0.8	I	S	1.5	I	S	1.5	I	S	2.0
LARGE INLINE	Up to 25 HP	---	---	---	---	S	0.75	---	S	1.50	---	S	1.50	---	---	NA
	26 HP THRU 30 HP	---	---	---	---	S	1.0	---	S	1.50	---	S	2.50	---	---	NA
BASE MOUNTED	UP TO 10 HP	---	---	---	---	D,L, W	---	---	D,L, W	---	---	D,L, W	---	---	D,L, W	---
	15 HP THRU 40 HP	I	S	1.0	I	S	1.0	I	S	2.0	I	S	2.0	I	S	2.0
	50 HP & OVER	I	S	1.0	I	S	1.0	I	S	2.0	I	S	2.5	I	S	2.5
<b>CENTRIFUGAL FANS</b>																
UP TO 50 HP:																
UP TO 200 RPM		B	N	0.3	B	S	2.5	B	S	2.5	B	S	3.5	B	S	3.5



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EQUIPMENT	ON GRADE			20FT FLOOR SPAN			30FT FLOOR SPAN			40FT FLOOR SPAN			50FT FLOOR SPAN		
	BASE TYPE	ISOL TYPE	MIN DEFL	BASE TYPE	ISOL TYPE	MIN DEFL	BASE TYPE	ISOL TYPE	MIN DEFL	BASE TYPE	ISOL TYPE	MIN DEFL	BASE TYPE	ISOL TYPE	MIN DEFL
201 - 300 RPM	B	N	0.3	B	S	2.0	B	S	2.5	B	S	2.5	B	S	3.5
301 - 500 RPM	B	N	0.3	B	S	2.0	B	S	2.0	B	S	2.5	B	S	3.5
501 RPM & OVER	B	N	0.3	B	S	2.0	B	S	2.0	B	S	2.0	B	S	2.5
60 HP & OVER:															
UP TO 300 RPM	B	S	2.0	I	S	2.5	I	S	3.5	I	S	3.5	I	S	3.5
301 - 500 RPM	B	S	2.0	I	S	2.0	I	S	2.5	I	S	3.5	I	S	3.5
501 RPM & OVER	B	S	1.0	I	S	2.0	I	S	2.0	I	S	2.5	I	S	2.5
AIR HANDLING UNIT PACKAGES															
SUSPENDED:															
UP THRU 5 HP	---	---	---	---	H	1.0	---	H	1.0	---	H	1.0	---	H	1.0
7-1/2 HP & OVER:															
UP TO 500 RPM	---	---	---	---	H, THR	1.5	---	H, THR	2.5	---	H, THR	2.5	---	H, THR	2.5
501 RPM & OVER	---	---	---	---	H, THR	0.8	---	H, THR	0.8	---	H,TH R	0.8	---	H,TH R	2.0
FLOOR MOUNTED:															
UP THRU 5 HP	---	D	---	---	S	1.0	---	S	1.0	---	S	1.0	---	S	1.0
7-1/2 HP & OVER:															
UP TO 500 RPM	---	D	---	R	S, THR	1.5	R	S, THR	2.5	R	S, THR	2.5	R	S, THR	2.5

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EQUIPMENT	ON GRADE			20FT FLOOR SPAN			30FT FLOOR SPAN			40FT FLOOR SPAN			50FT FLOOR SPAN		
	BASE TYPE	ISOL TYPE	MIN DEFL	BASE TYPE	ISOL TYPE	MIN DEFL	BASE TYPE	ISOL TYPE	MIN DEFL	BASE TYPE	ISOL TYPE	MIN DEFL	BASE TYPE	ISOL TYPE	MIN DEFL
501 RPM & OVER	---	D	---	---	S, THR	0.8	---	S, THR	0.8	R	S, THR	1.5	R	S, THR	2.0
<b>CONDENSING UNITS</b>															
ALL	---	SS	0.25	---	SS	0.75	---	SS	1.5	CB	SS	1.5	---	---	NA
<b>IN-LINE CENTRIFUGAL AND VANE AXIAL FANS, FLOOR MOUNTED: (APR 9)</b>															
UP THRU 50 HP:															
UP TO 300 RPM	---	D	---	R	S	2.5	R	S	2.5	R	S	2.5	R	S	3.5
301 - 500 RPM	---	D	---	R	S	2.0	R	S	2.0	R	S	2.5	R	S	2.5
501 - & OVER	---	D	---	---	S	1.0	---	S	1.0	R	S	2.0	R	S	2.5
60 HP AND OVER:															
301 - 500 RPM	R	S	1.0	R	S	2.0	R	S	2.0	R	S	2.5	R	S	3.5
501 RPM & OVER	R	S	1.0	R	S	2.0	R	S	2.0	R	S	2.0	R	S	2.5

**NOTES:**

1. Edit the Table above to suit where isolator, other than those shown, are used, such as for seismic restraints and position limit stops.
2. For suspended floors lighter than 100 mm (4 inch) thick concrete, select deflection requirements from next higher span.
3. For projects in seismic areas, use only SS & DS type isolators and snubbers.
5. For floor mounted in-line centrifugal blowers (ARR 1): use "B" type in lieu of "R" type base.
5. Suspended: Use "H" isolators of same deflection as floor mounted.

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**SECTION 23 05 93  
TESTING, ADJUSTING, AND BALANCING FOR HVAC**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

- A. Testing, adjusting, and balancing (TAB) of heating, ventilating and air conditioning (HVAC) systems. TAB includes the following:
  - 1. Planning systematic TAB procedures.
  - 2. Design Review Report.
  - 3. Systems Inspection report.
  - 4. Duct Air Leakage test report.
  - 5. Systems Readiness Report.
  - 6. Balancing air and water distribution systems; adjustment of total system to provide design performance; and testing performance of equipment and automatic controls.
  - 7. Vibration and sound measurements.
  - 8. Recording and reporting results.
- B. Definitions:
  - 1. Basic TAB used in this Section: Chapter 37, "Testing, Adjusting and Balancing" of 2007 ASHRAE Handbook, "HVAC Applications".
  - 2. TAB: Testing, Adjusting and Balancing; the process of checking and adjusting HVAC systems to meet design objectives.
  - 3. AABC: Associated Air Balance Council.
  - 4. NEBB: National Environmental Balancing Bureau.
  - 5. Hydronic Systems: Includes chilled water, heating hot water and glycol-water systems.
  - 6. Air Systems: Includes all outside air, supply air, return air, exhaust air and relief air systems.
  - 7. Flow rate tolerance: The allowable percentage variation, minus to plus, of actual flow rate from values (design) in the contract documents.

**1.2 RELATED WORK**

- A. Section 23 05 10, COMMON WORK RESULTS FOR BOILER PLANTS and STEAM GENERATION: General Mechanical Requirements.
- B. Section 23 05 11, COMMON WORK RESULTS FOR HVAC: General Mechanical Requirements.
- C. Section 23 05 41, NOISE AND VIBRATION CONTROL FOR HVAC PIPING AND EQUIPMENT: Noise and Vibration Requirements.

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- D. Section 23 07 11, HVAC, PLUMBING, AND BOILER PLANT INSULATION: Piping and Equipment Insulation.
- E. Section 23 64 00, PACKAGED WATER CHILLERS: Testing Refrigeration Equipment.
- F. Section 23 65 00, COOLING TOWERS: Cooling Tower Performance Testing.
- G. Section 23 36 00, AIR TERMINAL UNITS: Terminal Units Performance.
- H. Section 23 31 00, HVAC DUCTS AND CASINGS: Duct Leakage.
- I. Section 23 09 23, DIRECT-DIGITAL CONTROL SYSTEM FOR HVAC: Controls and Instrumentation Settings.
- J. Section 23 82 16, AIR COILS
- K. Section 23 82 00, CONVECTION HEATING AND COOLING UNITS
- L. Section 23 73 00, INDOOR CENTRAL-STATION AIR-HANDLING UNITS
- L. Section 23 34 00, HVAC FANS
- M. Section 23 21 23, HYDRONIC PUMPS
- N. Section 23 37 00, AIR OUTLETS AND INLETS
- O. Section 23 21 13, HYDRONIC PIPING
- P. Section 23 08 00, COMMISSIONING OF HVAC SYSTEMS. Requirements for commissioning, systems readiness checklists, and training
- Q. Section 23 05 12 GENERAL MOTOR REQUIREMENTS FOR HVAC AND STEAM GENERATION EQUIPMENT

**1.3 QUALITY ASSURANCE**

- A. Refer to Articles, Quality Assurance and Submittals, in Section 23 05 11, COMMON WORK RESULTS FOR HVAC, Section 23 05 10, COMMON WORK RESULTS FOR BOILER PLANTS and STEAM GENERATION, and Section 23 08 00, COMMISSIONING OF HVAC SYSTEMS.
- B. Qualifications:
  - 1. TAB Agency: The TAB agency shall be a subcontractor of the General Contractor and shall report to and be paid by the General Contractor.
  - 2. The TAB agency shall be either a certified member of AABC or certified by the NEBB to perform TAB service for HVAC, water balancing and vibrations and sound testing of equipment. The certification shall be maintained for the entire duration of duties specified herein. If, for any reason, the agency loses subject certification during this period, the General Contractor shall immediately notify the Resident Engineer and submit another TAB firm for approval. Any agency that has been the subject of disciplinary

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- action by either the AABC or the NEBB within the five years preceding Contract Award shall not be eligible to perform any work related to the TAB. All work performed in this Section and in other related Sections by the TAB agency shall be considered invalid if the TAB agency loses its certification prior to Contract completion, and the successor agency's review shows unsatisfactory work performed by the predecessor agency.
3. TAB Specialist: The TAB specialist shall be either a member of AABC or an experienced technician of the Agency certified by NEBB. The certification shall be maintained for the entire duration of duties specified herein. If, for any reason, the Specialist loses subject certification during this period, the General Contractor shall immediately notify the Resident Engineer and submit another TAB Specialist for approval. Any individual that has been the subject of disciplinary action by either the AABC or the NEBB within the five years preceding Contract Award shall not be eligible to perform any duties related to the HVAC systems, including TAB. All work specified in this Section and in other related Sections performed by the TAB specialist shall be considered invalid if the TAB Specialist loses its certification prior to Contract completion and must be performed by an approved successor.
  4. TAB Specialist shall be identified by the General Contractor within 60 days after the notice to proceed. The TAB specialist will be coordinating, scheduling and reporting all TAB work and related activities and will provide necessary information as required by the Resident Engineer. The responsibilities would specifically include:
    - a. Shall directly supervise all TAB work.
    - b. Shall sign the TAB reports that bear the seal of the TAB standard. The reports shall be accompanied by report forms and schematic drawings required by the TAB standard, AABC or NEBB.
    - c. Would follow all TAB work through its satisfactory completion.
    - d. Shall provide final markings of settings of all HVAC adjustment devices.
    - e. Permanently mark location of duct test ports.
  5. All TAB technicians performing actual TAB work shall be experienced and must have done satisfactory work on a minimum of 3 projects comparable in size and complexity to this project. Qualifications

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must be certified by the TAB agency in writing. The lead technician shall be certified by AABC or NEBB

- C. Test Equipment Criteria: The instrumentation shall meet the accuracy/calibration requirements established by AABC National Standards or by NEBB Procedural Standards for Testing, Adjusting and Balancing of Environmental Systems and instrument manufacturer. Provide calibration history of the instruments to be used for test and balance purpose.
- D. Tab Criteria:
1. One or more of the applicable AABC, NEBB or SMACNA publications, supplemented by ASHRAE Handbook "HVAC Applications" Chapter 36, and requirements stated herein shall be the basis for planning, procedures, and reports.
  2. Flow rate tolerance: Following tolerances are allowed. For tolerances not mentioned herein follow ASHRAE Handbook "HVAC Applications", Chapter 36, as a guideline. Air Filter resistance during tests, artificially imposed if necessary, shall be at least 100 percent of manufacturer recommended change over pressure drop values for pre-filters and after-filters.
    - a. Air handling unit and all other fans, cubic meters/min (cubic feet per minute): Minus 0 percent to plus 10 percent.
    - b. Air terminal units (maximum values): Minus 2 percent to plus 10 percent.
    - c. Minimum outside air: 0 percent to plus 10 percent.
    - d. Individual room air outlets and inlets, and air flow rates not mentioned above: Minus 5 percent to plus 10 percent except if the air to a space is 100 CFM or less the tolerance would be minus 5 to plus 5 percent.
    - e. Heating hot water pumps and hot water coils: Minus 5 percent to plus 5 percent.
    - f. Chilled water coils: Minus 0 percent to plus 5 percent.
  3. Systems shall be adjusted for energy efficient operation as described in PART 3.
  4. Typical TAB procedures and results shall be demonstrated to the Resident Engineer for one air distribution system (including all fans, three terminal units, three rooms randomly selected by the

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Resident Engineer) and one hydronic system (pumps and three coils)  
as follows:

- a. When field TAB work begins.
- b. During each partial final inspection and the final inspection for the project if requested by VA.

**1.4 SUBMITTALS**

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, and SAMPLES.
- B. Submit names and qualifications of TAB agency and TAB specialists within 60 days after the notice to proceed. Submit information on three recently completed projects and a list of proposed test equipment.
- C. For use by the Resident Engineer staff, submit one complete set of applicable AABC or NEBB publications that will be the basis of TAB work.
- D. Submit Following for Review and Approval:
  1. Design Review Report within 90 days after the system layout on air and water side is completed by the Contractor.
  2. Systems inspection report on equipment and installation for conformance with design.
  3. Duct Air Leakage Test Report.
  4. Systems Readiness Report.
  5. Intermediate and Final TAB reports covering flow balance and adjustments, performance tests, vibration tests and sound tests.
  6. Include in final reports uncorrected installation deficiencies noted during TAB and applicable explanatory comments on test results that differ from design requirements.
- E. Prior to request for Final or Partial Final inspection, submit completed Test and Balance report for the area.

**1.5 APPLICABLE PUBLICATIONS**

- A. The following publications form a part of this specification to the extent indicated by the reference thereto. In text the publications are referenced to by the acronym of the organization.
- B. American Society of Heating, Refrigerating and Air Conditioning Engineers, Inc. (ASHRAE):  
2007 .....HVAC Applications ASHRAE Handbook, Chapter 37,  
Testing, Adjusting, and Balancing and Chapter  
47, Sound and Vibration Control

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C. Associated Air Balance Council (AABC):

2002 .....AABC National Standards for Total System  
Balance

D. National Environmental Balancing Bureau (NEBB):

7<sup>th</sup> Edition 2005 .....Procedural Standards for Testing, Adjusting,  
Balancing of Environmental Systems

2nd Edition 2006 .....Procedural Standards for the Measurement of  
Sound and Vibration

3<sup>rd</sup> Edition 2009 .....Procedural Standards for Whole Building Systems  
Commissioning of New Construction

E. Sheet Metal and Air Conditioning Contractors National Association  
(SMACNA):

3<sup>rd</sup> Edition 2002 .....HVAC SYSTEMS Testing, Adjusting and Balancing

**PART 2 - PRODUCTS**

**2.1 PLUGS**

Provide plastic plugs to seal holes drilled in ductwork for test  
purposes.

**2.2 INSULATION REPAIR MATERIAL**

See Section 23 07 11, HVAC and BOILER PLANT INSULATION Provide for  
repair of insulation removed or damaged for TAB work.

**PART 3 - EXECUTION**

**3.1 GENERAL**

- A. Refer to TAB Criteria in Article, Quality Assurance.
- B. Obtain applicable contract documents and copies of approved submittals  
for HVAC equipment and automatic control systems.

**3.2 DESIGN REVIEW REPORT**

The TAB Specialist shall review the Contract Plans and specifications  
and advise the Resident Engineer of any design deficiencies that would  
prevent the HVAC systems from effectively operating in accordance with  
the sequence of operation specified or prevent the effective and  
accurate TAB of the system. The TAB Specialist shall provide a report  
individually listing each deficiency and the corresponding proposed  
corrective action necessary for proper system operation.

**3.3 SYSTEMS INSPECTION REPORT**

- A. Inspect equipment and installation for conformance with design.
- B. The inspection and report is to be done after air distribution  
equipment is on site and duct installation has begun, but well in



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advance of performance testing and balancing work. The purpose of the inspection is to identify and report deviations from design and ensure that systems will be ready for TAB at the appropriate time.

- C. Reports: Follow check list format developed by AABC, NEBB or SMACNA, supplemented by narrative comments, with emphasis on air handling units and fans. Check for conformance with submittals. Verify that diffuser and register sizes are correct. Check air terminal unit installation including their duct sizes and routing.

**3.4 DUCT AIR LEAKAGE TEST REPORT**

TAB Agency shall perform the leakage test as outlined in "Duct leakage Tests and Repairs" in Section 23 31 00, HVAC DUCTS and CASINGS for TAB agency's role and responsibilities in witnessing, recording and reporting of deficiencies.

**3.5 SYSTEM READINESS REPORT**

- A. The TAB Contractor shall measure existing air and water flow rates associated with existing systems utilized to serve renovated areas as indicated on drawings. Submit report of findings to resident engineer.
- B. Inspect each System to ensure that it is complete including installation and operation of controls. Submit report to RE in standard format and forms prepared and or approved by the Commissioning Agent.
- C. Verify that all items such as ductwork piping, ports, terminals, connectors, etc., that is required for TAB are installed. Provide a report to the Resident Engineer.

**3.6 TAB REPORTS**

- A. Submit an intermediate report for 50 percent of systems and equipment tested and balanced to establish satisfactory test results.
- B. The TAB contractor shall provide raw data immediately in writing to the Resident Engineer if there is a problem in achieving intended results before submitting a formal report.
- C. If over 20 percent of readings in the intermediate report fall outside the acceptable range, the TAB report shall be considered invalid and all contract TAB work shall be repeated and re-submitted for approval at no additional cost to the owner.
- D. Do not proceed with the remaining systems until intermediate report is approved by the Resident Engineer.

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**3.7 TAB PROCEDURES**

- A. Tab shall be performed in accordance with the requirement of the Standard under which TAB agency is certified by either AABC or NEBB.
- B. General: During TAB all related system components shall be in full operation. Fan and pump rotation, motor loads and equipment vibration shall be checked and corrected as necessary before proceeding with TAB. Set controls and/or block off parts of distribution systems to simulate design operation of variable volume air or water systems for test and balance work.
- C. Coordinate TAB procedures with existing systems and any phased construction completion requirements for the project. Provide TAB reports for pre construction air and water flow rate and for each phase of the project prior to partial final inspections of each phase of the project. Return existing areas outside the work area to pre constructed conditions.
- D. Allow 30 days time in construction schedule for TAB and submission of all reports for an organized and timely correction of deficiencies.
- E. Air Balance and Equipment Test: Include air handling units, fans, terminal units, fan coil units, room diffusers/outlets/inlets, and induction units.
  - 1. Artificially load air filters by partial blanking to produce air pressure drop of manufacturer's recommended pressure drop.
  - 2. Adjust fan speeds to provide design air flow. V-belt drives, including fixed pitch pulley requirements, are specified in Section 23 05 11, COMMON WORK RESULTS FOR HVAC.
  - 3. Test and balance systems in all specified modes of operation, including variable volume, economizer, and fire emergency modes. Verify that dampers and other controls function properly.
  - 4. Variable air volume (VAV) systems:
    - a. Coordinate TAB, including system volumetric controls, with Section 23 09 23, DIRECT-DIGITAL CONTROL SYSTEM FOR HVAC.
    - b. Section 23 36 00, AIR TERMINAL UNITS, specifies that maximum and minimum flow rates for air terminal units (ATU) be factory set. Check and readjust ATU flow rates. Balance air distribution from ATU on full cooling maximum scheduled cubic meters per minute (cubic feet per minute). Reset room thermostats and check ATU operation from maximum to minimum cooling, to the heating mode,

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and back to cooling. Record and report the heating coil leaving air temperature when the ATU is in the maximum heating mode.

Record and report outdoor air flow rates under all operating conditions (The test shall demonstrate that the minimum outdoor air ventilation rate shall remain constant under all operating conditions).

- c. Adjust operating pressure control setpoint to maintain the design flow to each space with the lowest setpoint.

- 5. Record final measurements for air handling equipment performance data sheets.

**F. Water Balance and Equipment Test: Include circulating pumps, convertors, coils, coolers:**

- 1. Adjust flow rates for equipment. Set coils and evaporator to values on equipment submittals, if different from values on contract drawings.
- 2. Primary-secondary (variable volume) systems: Coordinate TAB with Section 23 09 23, DIRECT-DIGITAL CONTROL SYSTEM FOR HVAC. Balance systems at design water flow and then verify that variable flow controls function as designed.
- 3. Record final measurements for hydronic equipment on performance data sheets. Include entering and leaving water temperatures for heating and cooling coils, and for convertors. Include entering and leaving air temperatures (DB/WB for cooling coils) for air handling units and reheat coils. Make air and water temperature measurements at the same time.

**3.8 VIBRATION TESTING**

- A. Furnish instruments and perform vibration measurements as specified in Section 23 05 41, NOISE and VIBRATION CONTROL FOR HVAC PIPING and EQUIPMENT. Field vibration balancing is specified in Section 23 05 11, COMMON WORK RESULTS FOR HVAC. Provide measurements for all rotating HVAC equipment of 373 watts (1/2 horsepower) and larger.
- B. Record initial measurements for each unit of equipment on test forms and submit a report to the Resident Engineer. Where vibration readings exceed the allowable tolerance Contractor shall be directed to correct the problem. The TAB agency shall verify that the corrections are done and submit a final report to the Resident Engineer.

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**3.9 SOUND TESTING**

- A. Perform and record required sound measurements in accordance with Paragraph, QUALITY ASSURANCE in Section 23 05 41, NOISE and VIBRATION CONTROL FOR HVAC PIPING and EQUIPMENT.
1. Take readings in rooms, approximately fifteen (15) percent of all rooms. The Resident Engineer may designate the specific rooms to be tested.
- B. Take measurements with a calibrated sound level meter and octave band analyzer of the accuracy required by AABC or NEBB.
- C. Sound reference levels, formulas and coefficients shall be according to ASHRAE Handbook, "HVAC Applications", Chapter 46, SOUND AND VIBRATION CONTROL.
- D. Determine compliance with specifications as follows:
1. When sound pressure levels are specified, including the NC Criteria in Section 23 05 41, NOISE and VIBRATION CONTROL FOR HVAC PIPING and EQUIPMENT:
- a. Reduce the background noise as much as possible by shutting off unrelated audible equipment.
- b. Measure octave band sound pressure levels with specified equipment "off."
- c. Measure octave band sound pressure levels with specified equipment "on."
- d. Use the DIFFERENCE in corresponding readings to determine the sound pressure due to equipment.

DIFFERENCE:	0	1	2	3	4	5 to 9	10 or More
FACTOR:	10	7	4	3	2	1	0

Sound pressure level due to equipment equals sound pressure level with equipment "on" minus FACTOR.

- e. Plot octave bands of sound pressure level due to equipment for typical rooms on a graph which also shows noise criteria (NC) curves.
2. When sound power levels are specified:
- a. Perform steps 1.a. thru 1.d., as above.
- b. For indoor equipment: Determine room attenuating effect, i.e., difference between sound power level and sound pressure level.

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Determined sound power level will be the sum of sound pressure level due to equipment plus the room attenuating effect.

- E. Where measured sound levels exceed specified level, the installing contractor or equipment manufacturer shall take remedial action approved by the Resident Engineer and the necessary sound tests shall be repeated.
- F. Test readings for sound testing could go higher than 15 percent if determination is made by the Resident Engineer based on the recorded sound data.

**3.10 MARKING OF SETTINGS**

Following approval of Tab final Report, the setting of all HVAC adjustment devices including valves, splitters and dampers shall be permanently marked by the TAB Specialist so that adjustment can be restored if disturbed at any time. Style and colors used for markings shall be coordinated with the Resident Engineer.

**3.11 IDENTIFICATION OF TEST PORTS**

The TAB Specialist shall permanently and legibly identify the location points of duct test ports. If the ductwork has exterior insulation, the identification shall be made on the exterior side of the insulation. All penetrations through ductwork and ductwork insulation shall be sealed to prevent air leaks and maintain integrity of vapor barrier.

**3.12 PHASING**

- A. Phased Projects: Testing and Balancing Work to follow project with areas shall be completed per the project phasing. Upon completion of the project all areas shall have been tested and balanced per the contract documents.
- B. Existing Areas: Systems that serve areas outside of the project scope shall not be adversely affected. Measure existing parameters where shown to document system capacity.

**3.13 COMMISSIONING**

- A. Provide commissioning documentation in accordance with the requirements of Section 23 08 00 - COMMISSIONING OF HVAC SYSTEMS for all inspection, start up, and contractor testing required above and required by the System Readiness Checklist provided by the Commissioning Agent.
- B. Components provided under this section of the specification will be tested as part of a larger system. Refer to Section 23 08 00 -

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COMMISSIONING OF HVAC SYSTEMS and related sections for contractor  
responsibilities for system commissioning.

- - E N D - - -

SECTION 23 07 11  
HVAC AND BOILER PLANT INSULATION

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Field applied insulation for thermal efficiency and condensation control for
  - 1. HVAC piping, ductwork and equipment.
  - 3. Re-insulation of HVAC piping, ductwork and equipment, plumbing piping and equipment after asbestos abatement.
- B. Definitions
  - 1. ASJ: All service jacket, white finish facing or jacket.
  - 2. Air conditioned space: Space having air temperature and/or humidity controlled by mechanical equipment.
  - 3. Cold: Equipment, ductwork or piping handling media at design temperature of 16 degrees C (60 degrees F) or below.
  - 4. Concealed: Ductwork and piping above ceilings and in chases, and pipe spaces.
  - 5. Exposed: Piping, ductwork, and equipment exposed to view in finished areas including mechanical and electrical equipment rooms. Attics and crawl spaces where air handling units are located are considered to be mechanical rooms. Shafts, chases, unfinished attics, crawl spaces and pipe basements are not considered finished areas.
  - 6. FSK: Foil-scrim-kraft facing.
  - 7. Hot: HVAC Ductwork handling air at design temperature above 16 degrees C (60 degrees F); HVAC equipment or piping handling media above 41 degrees C (105 degrees F).
  - 8. Density:  $\text{kg/m}^3$  - kilograms per cubic meter (Pcf - pounds per cubic foot).
  - 9. Runouts: Branch pipe connections up to 25-mm (one-inch) nominal size to fan coil units or reheat coils for terminal units.
  - 10. Thermal conductance: Heat flow rate through materials.
    - a. Flat surface: Watt per square meter (BTU per hour per square foot).
    - b. Pipe or Cylinder: Watt per square meter (BTU per hour per linear foot).

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11. Thermal Conductivity (k): Watt per meter, per degree C (BTU per inch thickness, per hour, per square foot, per degree F temperature difference).
12. Vapor Retarder (Vapor Barrier): A material which retards the transmission (migration) of water vapor. Performance of the vapor retarder is rated in terms of permeance (perms). For the purpose of this specification, vapor retarders shall have a maximum published permeance of 0.1 perms and vapor barriers shall have a maximum published permeance of 0.001 perms.
13. HPS: High pressure steam (415 kPa [60 psig] and above).
14. HPR: High pressure steam condensate return.
15. MPS: Medium pressure steam (110 kPa [16 psig] thru 414 kPa [59 psig]).
16. MPR: Medium pressure steam condensate return.
17. LPS: Low pressure steam (103 kPa [15 psig] and below).
18. LPR: Low pressure steam condensate gravity return.
19. PC: Pumped condensate.
20. HWH: Hot water heating supply.
21. HWHR: Hot water heating return.
22. GH: Hot glycol-water heating supply.
23. GHR: Hot glycol-water heating return.
24. CTPD: Condensate transfer pump discharge.
25. CTPS: Condensate transfer pump suction.
26. CPD: Condensate pump discharge.
27. CW: Cold water.
28. CH: Chilled water supply.
29. CHR: Chilled water return.
30. GC: Chilled glycol-water supply.
31. GCR: Chilled glycol-water return.
32. PVDC: Polyvinylidene chloride vapor retarder jacketing, white.

**1.2 RELATED WORK**

- A. Section 02 82 11, TRADITIONAL ASBESTOS ABATEMENT: Insulation containing asbestos material.
- B. Section 02 82 13.13, GLOVEBAG ASBESTOS ABATEMENT: Insulation containing asbestos material.
- C. Section 07 84 00, FIRESTOPPING: Mineral fiber and bond breaker behind sealant.



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- D. Section 23 05 11, COMMON WORK RESULTS FOR HVAC: General mechanical requirements and items, which are common to more than one section of Division 23.
- E. Section 23 05 41, NOISE AND VIBRATION CONTROL FOR HVAC PIPING and EQUIPMENT
- F. Section 23 21 23, HYDRONIC PUMPS
- G. Section 23 22 13, STEAM and CONDENSATE HEATING PIPING
- H. Section 23 22 23, STEAM CONDENSATE PUMPS
- I. Section 23 21 13, HYDRONIC PIPING and Section 23 22 13, STEAM and CONDENSATE HEATING PIPING: Piping and equipment.
- J. Section 23 21 13, HYDRONIC PIPING: Hot water, chilled water, and glycol piping.
- K. Section 23 31 00, HVAC DUCTS AND CASINGS: Ductwork, plenum and fittings.

**1.3 QUALITY ASSURANCE**

- A. Refer to article QUALITY ASSURANCE, in Section 23 05 11, COMMON WORK RESULTS FOR HVAC.
- B. Criteria:
  - 1. Comply with NFPA 90A, particularly paragraphs 4.3.3.1 through 4.3.3.6, 4.3.10.2.6, and 5.4.6.4, parts of which are quoted as follows:
    - 4.3.3.1** Pipe insulation and coverings, duct coverings, duct linings, vapor retarder facings, adhesives, fasteners, tapes, and supplementary materials added to air ducts, plenums, panels, and duct silencers used in duct systems, unless otherwise provided for in 4.3.3.1.1 or 4.3.3.1.2., shall have, in the form in which they are used, a maximum flame spread index of 25 without evidence of continued progressive combustion and a maximum smoke developed index of 50 when tested in accordance with NFPA 255, *Standard Method of Test of Surface Burning Characteristics of Building Materials*.
    - 4.3.3.1.1** Where these products are to be applied with adhesives, they shall be tested with such adhesives applied, or the adhesives used shall have a maximum flame spread index of 25 and a maximum smoke developed index of 50 when in the final dry state. (See 4.2.4.2.)
    - 4.3.3.1.2** The flame spread and smoke developed index requirements of 4.3.3.1.1 shall not apply to air duct weatherproof coverings where they are located entirely outside of a building, do not penetrate a wall or roof, and do not create an exposure hazard.
    - 4.3.3.2** Closure systems for use with rigid and flexible air ducts tested in accordance with UL 181, Standard for Safety Factory-Made Air Ducts and Air Connectors, shall have been tested,

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listed, and used in accordance with the conditions of their listings, in accordance with one of the following:

(1) UL 181A, Standard for Safety Closure Systems for Use with Rigid Air Ducts and Air Connectors

(2) UL 181B, Standard for Safety Closure Systems for Use with Flexible Air Ducts and Air Connectors

4.3.3.3 Air duct, panel, and plenum coverings and linings, and pipe insulation and coverings shall not flame, glow, smolder, or smoke when tested in accordance with a similar test for pipe covering, ASTM C 411, Standard Test Method for Hot-Surface Performance of High-Temperature Thermal Insulation, at the temperature to which they are exposed in service.

4.3.3.3.1 In no case shall the test temperature be below 121°C (250°F).

4.3.3.4 Air duct coverings shall not extend through walls or floors that are required to be fire stopped or required to have a fire resistance rating, unless such coverings meet the requirements of 5.4.6.4.

4.3.3.5\* Air duct linings shall be interrupted at fire dampers to prevent interference with the operation of devices.

4.3.3.6 Air duct coverings shall not be installed so as to conceal or prevent the use of any service opening.

4.3.10.2.6 Materials exposed to the airflow shall be noncombustible or limited combustible and have a maximum smoke developed index of 50 or comply with the following.

4.3.10.2.6.1 Electrical wires and cables and optical fiber cables shall be listed as noncombustible or limited combustible and have a maximum smoke developed index of 50 or shall be listed as having a maximum peak optical density of 0.5 or less, an average optical density of 0.15 or less, and a maximum flame spread distance of 1.5 m (5 ft) or less when tested in accordance with NFPA 262, Standard Method of Test for Flame Travel and Smoke of Wires and Cables for Use in Air-Handling Spaces.

4.3.10.2.6.2 Pneumatic tubing for control systems shall be listed as having a maximum peak optical density of 0.5 or less, an average optical density of 0.15 or less, and a maximum flame spread distance of 1.5 m (5 ft) or less when tested in accordance with UL 1820, Standard for Safety Fire Test of Pneumatic Tubing for Flame and Smoke Characteristics.

4.3.10.2.6.4 Optical-fiber and communication raceways shall be listed as having a maximum peak optical density of 0.5 or less, an average optical density of 0.15 or less, and a maximum flame spread distance of 1.5 m (5 ft) or less when tested in accordance with UL 2024, Standard for Safety Optical-Fiber Cable Raceway.

4.3.10.2.6.6 Supplementary materials for air distribution systems shall be permitted when complying with the provisions of 4.3.3.

5.4.6.4 Where air ducts pass through walls, floors, or partitions that are required to have a fire resistance rating and where fire

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dampers are not required, the opening in the construction around the air duct shall be as follows:

- (1) Not exceeding a 25.4 mm (1 in.) average clearance on all sides
  - (2) Filled solid with an approved material capable of preventing the passage of flame and hot gases sufficient to ignite cotton waste when subjected to the time-temperature fire conditions required for fire barrier penetration as specified in NFPA 251, *Standard Methods of Tests of Fire Endurance of Building Construction and Materials*
2. Test methods: ASTM E84, UL 723, or NFPA 255.
  3. Specified k factors are at 24 degrees C (75 degrees F) mean temperature unless stated otherwise. Where optional thermal insulation material is used, select thickness to provide thermal conductance no greater than that for the specified material. For pipe, use insulation manufacturer's published heat flow tables. For domestic hot water supply and return, run out insulation and condensation control insulation, no thickness adjustment need be made.
  4. All materials shall be compatible and suitable for service temperature, and shall not contribute to corrosion or otherwise attack surface to which applied in either the wet or dry state.
- C. Every package or standard container of insulation or accessories delivered to the job site for use must have a manufacturer's stamp or label giving the name of the manufacturer and description of the material.

**1.4 SUBMITTALS**

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, and SAMPLES.
- B. Shop Drawings:
  1. All information, clearly presented, shall be included to determine compliance with drawings and specifications and ASTM, federal and military specifications.
    - a. Insulation materials: Specify each type used and state surface burning characteristics.
    - b. Insulation facings and jackets: Each type used. Make it clear that white finish will be furnished for exposed ductwork, casings and equipment.
    - c. Insulation accessory materials: Each type used.

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- d. Manufacturer's installation and fitting fabrication instructions for flexible unicellular insulation.
- e. Make reference to applicable specification paragraph numbers for coordination.

**1.5 STORAGE AND HANDLING OF MATERIAL**

Store materials in clean and dry environment, pipe covering jackets shall be clean and unmarred. Place adhesives in original containers. Maintain ambient temperatures and conditions as required by printed instructions of manufacturers of adhesives, mastics and finishing cements.

**1.6 APPLICABLE PUBLICATIONS**

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by basic designation only.
- B. Federal Specifications (Fed. Spec.):
  - L-P-535E (2)- 99 .....Plastic Sheet (Sheeting): Plastic Strip; Poly (Vinyl Chloride) and Poly (Vinyl Chloride - Vinyl Acetate), Rigid.
- C. Military Specifications (Mil. Spec.):
  - MIL-A-3316C (2)-90 .....Adhesives, Fire-Resistant, Thermal Insulation
  - MIL-A-24179A (1)-87 ....Adhesive, Flexible Unicellular-Plastic Thermal Insulation
  - MIL-C-19565C (1)-88 ....Coating Compounds, Thermal Insulation, Fire-and Water-Resistant, Vapor-Barrier
  - MIL-C-20079H-87 .....Cloth, Glass; Tape, Textile Glass; and Thread, Glass and Wire-Reinforced Glass
- D. American Society for Testing and Materials (ASTM):
  - A167-99(2004) .....Standard Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip
  - B209-07 .....Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate
  - C411-05 .....Standard test method for Hot-Surface Performance of High-Temperature Thermal Insulation

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C449-07 .....Standard Specification for Mineral Fiber  
Hydraulic-Setting Thermal Insulating and  
Finishing Cement

C533-09 .....Standard Specification for Calcium Silicate  
Block and Pipe Thermal Insulation

C534-08 .....Standard Specification for Preformed Flexible  
Elastomeric Cellular Thermal Insulation in  
Sheet and Tubular Form

C547-07 .....Standard Specification for Mineral Fiber pipe  
Insulation

C552-07 .....Standard Specification for Cellular Glass  
Thermal Insulation

C553-08 .....Standard Specification for Mineral Fiber  
Blanket Thermal Insulation for Commercial and  
Industrial Applications

C585-09 .....Standard Practice for Inner and Outer Diameters  
of Rigid Thermal Insulation for Nominal Sizes  
of Pipe and Tubing (NPS System) R (1998)

C612-10 .....Standard Specification for Mineral Fiber Block  
and Board Thermal Insulation

C1126-04 .....Standard Specification for Faced or Unfaced  
Rigid Cellular Phenolic Thermal Insulation

C1136-10 .....Standard Specification for Flexible, Low  
Permeance Vapor Retarders for Thermal  
Insulation

D1668-97a (2006) .....Standard Specification for Glass Fabrics (Woven  
and Treated) for Roofing and Waterproofing

E84-10 .....Standard Test Method for Surface Burning  
Characteristics of Building  
Materials

E119-09c .....Standard Test Method for Fire Tests of Building  
Construction and Materials

E136-09b .....Standard Test Methods for Behavior of Materials  
in a Vertical Tube Furnace at 750 degrees C  
(1380 F)

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**E. National Fire Protection Association (NFPA):**

- 90A-09 .....Standard for the Installation of Air  
Conditioning and Ventilating Systems
- 96-08 .....Standards for Ventilation Control and Fire  
Protection of Commercial Cooking Operations
- 101-09 .....Life Safety Code
- 251-06 .....Standard methods of Tests of Fire Endurance of  
Building Construction Materials
- 255-06 .....Standard Method of tests of Surface Burning  
Characteristics of Building Materials

**F. Underwriters Laboratories, Inc (UL):**

- 723 .....UL Standard for Safety Test for Surface Burning  
Characteristics of Building Materials with  
Revision of 09/08

**G. Manufacturer's Standardization Society of the Valve and Fitting  
Industry (MSS):**

- SP58-2009 .....Pipe Hangers and Supports Materials, Design,  
and Manufacture

**PART 2 - PRODUCTS**

**2.1 MINERAL FIBER OR FIBER GLASS**

- A. ASTM C612 (Board, Block), Class 1 or 2, density 48 kg/m<sup>3</sup> (3 pcf), k = 0.037 (0.26) at 24 degrees C (75 degrees F), external insulation for temperatures up to 204 degrees C (400 degrees F) with foil scrim (FSK) facing.
- B. ASTM C553 (Blanket, Flexible) Type I, // Class B-3, Density 16 kg/m<sup>3</sup> (1 pcf), k = 0.045 (0.31) // Class B-5, Density 32 kg/m<sup>3</sup> (2 pcf), k = 0.04 (0.27) // at 24 degrees C (75 degrees F), for use at temperatures up to 204 degrees C (400 degrees F) with foil scrim (FSK) facing.
- C. ASTM C547 (Pipe Fitting Insulation and Preformed Pipe Insulation), Class 1, k = 0.037 (0.26) at 24 degrees C (75 degrees F), for use at temperatures up to 230 degrees C (450 degrees F) with an all service vapor retarder jacket with polyvinyl chloride premolded fitting covering.

**2.2 MINERAL WOOL OR REFRACTORY FIBER**

- A. Comply with Standard ASTM C612, Class 3, 450 degrees C (850 degrees F).

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**2.3 RIGID CELLULAR PHENOLIC FOAM**

- A. Preformed (molded) pipe insulation, ASTM C1126, type III, grade 1, k = 0.021(0.15) at 10 degrees C (50 degrees F), for use at temperatures up to 121 degrees C (250 degrees F) with all service vapor retarder jacket with polyvinyl chloride premolded fitting covering.
- B. Equipment and Duct Insulation, ASTM C 1126, type II, grade 1, k = 0.021 (0.15) at 10 degrees C (50 degrees F), for use at temperatures up to 121 degrees C (250 degrees F) with rigid cellular phenolic insulation and covering, and all service vapor retarder jacket.

**2.4 CELLULAR GLASS CLOSED-CELL**

- A. Comply with Standard ASTM C177, C518, density 120 kg/m<sup>3</sup> (7.5 pcf) nominal, k = 0.033 (0.29) at 24~~0~~ degrees C (75 degrees F).
- B. Pipe insulation for use at temperatures up to 200 degrees C (400 degrees F) with all service vapor retarder jacket.

**2.5 FLEXIBLE ELASTOMERIC CELLULAR THERMAL**

ASTM C177, C518, k = 0.039 (0.27) at 24 degrees C (75 degrees F), flame spread not over 25, smoke developed not over 50, for temperatures from minus 4 degrees C (40 degrees F) to 93 degrees C (200 degrees F). No jacket required.

**2.6 CALCIUM SILICATE**

- A. Preformed pipe Insulation: ASTM C533, Type I and Type II with indicator denoting asbestos-free material.
- B. Premolded Pipe Fitting Insulation: ASTM C533, Type I and Type II with indicator denoting asbestos-free material.
- C. Equipment Insulation: ASTM C533, Type I and Type II
- D. Characteristics:

Insulation Characteristics		
ITEMS	TYPE I	TYPE II
Temperature, maximum degrees C (degrees F)	649 (1200)	927 (1700)
Density (dry), Kg/m <sup>3</sup> (lb/ ft <sup>3</sup> )	232 (14.5)	288 (18)
Thermal conductivity: Min W/ m K (Btu in/h ft <sup>2</sup> degrees F)@ mean temperature of 93 degrees C (200 degrees F)	0.059 (0.41)	0.078 (0.540)

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Surface burning characteristics:		
Flame spread Index, Maximum	0	0
Smoke Density index, Maximum	0	0

**2.7 INSULATION FACINGS AND JACKETS**

- A. Vapor Retarder, higher strength with low water permeance  $\leq 0.02$  or less perm rating, Beach puncture 50 units for insulation facing on exposed ductwork, casings and equipment, and for pipe insulation jackets. Facings and jackets shall be all service type (ASJ) or PVDC Vapor Retarder jacketing.
- B. ASJ jacket shall be white kraft bonded to 0.025 mm (1 mil) thick aluminum foil, fiberglass reinforced, with pressure sensitive adhesive closure. Comply with ASTM C1136. Beach puncture 50 units, Suitable for painting without sizing. Jackets shall have minimum 40 mm (1-1/2 inch) lap on longitudinal joints and minimum 75 mm (3 inch) butt strip on end joints. Butt strip material shall be same as the jacket. Lap and butt strips shall be self-sealing type with factory-applied pressure sensitive adhesive.
- C. Vapor Retarder medium strength with low water vapor permeance of 0.02 or less perm rating), Beach puncture 25 units: Foil-Scrim-Kraft (FSK) or PVDC vapor retarder jacketing type for concealed ductwork and equipment.
- D. Field applied vapor barrier jackets shall be provided, in addition to the specified facings and jackets, on all exterior piping and ductwork as well as on interior piping and ductwork exposed to outdoor air (i.e.; in ventilated attics, piping in ventilated (not air conditioned) spaces, etc.) in high humidity areas//conveying fluids below ambient temperature. The vapor barrier jacket shall consist of a multi-layer laminated cladding with a maximum water vapor permeance of 0.001 perms. The minimum puncture resistance shall be 35 cm-kg (30 inch-pounds) for interior locations and 92 cm-kg (80 inch-pounds) for exterior or exposed locations or where the insulation is subject to damage.
- E. Glass Cloth Jackets: Presized, minimum 0.18 kg per square meter (7.8 ounces per square yard), 2000 kPa (300 psig) bursting strength with integral vapor retarder where required or specified. Weather proof if utilized for outside service.
- F. Factory composite materials may be used provided that they have been tested and certified by the manufacturer.



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- G. Pipe fitting insulation covering (jackets): Fitting covering shall be premolded to match shape of fitting and shall be polyvinyl chloride (PVC) conforming to Fed Spec L-P-335, composition A, Type II Grade GU, and Type III, minimum thickness 0.7 mm (0.03 inches). Provide color matching vapor retarder pressure sensitive tape.
- H. Aluminum Jacket-Piping systems: ASTM B209, 3003 alloy, H-14 temper, 0.6 mm (0.023 inch) minimum thickness with locking longitudinal joints. Jackets for elbows, tees and other fittings shall be factory-fabricated to match shape of fitting and of 0.6 mm (0.024) inch minimum thickness aluminum. Fittings shall be of same construction as straight run jackets but need not be of the same alloy. Factory-fabricated stainless steel bands shall be installed on all circumferential joints. Bands shall be 13 mm (0.5 inch) wide on 450 mm (18 inch) centers. System shall be weatherproof if utilized for outside service.

**2.10 REMOVABLE INSULATION JACKETS**

- A. Insulation and Jacket:
1. Non-Asbestos Glass mat, type E needled fiber.
  2. Temperature maximum of 450°F, Maximum water vapor transmission of 0.00 perm, and maximum moisture absorption of 0.2 percent by volume.
  3. Jacket Material: Silicon/fiberglass and LFP 2109 pure PTFE.
  4. Construction: One piece jacket body with three-ply braided pure Teflon or Kevlar thread and insulation sewn as part of jacket. Belt fastened.

**2.11 PIPE COVERING PROTECTION SADDLES**

- A. Cold pipe support: Premolded pipe insulation 180 degrees (half-shells) on bottom half of pipe at supports. Material shall be cellular glass or high density Polyisocyanurate insulation of the same thickness as adjacent insulation. Density of Polyisocyanurate insulation shall be a minimum of 48 kg/m<sup>3</sup> (3.0 pcf).

Nominal Pipe Size and Accessories Material (Insert Blocks)	
Nominal Pipe Size mm (inches)	Insert Blocks mm (inches)
Up through 125 (5)	150 (6) long
150 (6)	150 (6) long
200 (8), 250 (10), 300 (12)	225 (9) long
350 (14), 400 (16)	300 (12) long
450 through 600 (18 through 24)	350 (14) long

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- B. Warm or hot pipe supports: Premolded pipe insulation (180 degree half-shells) on bottom half of pipe at supports. Material shall be high density Polyisocyanurate (for temperatures up to 149 degrees C [300 degrees F]), cellular glass or calcium silicate. Insulation at supports shall have same thickness as adjacent insulation. Density of Polyisocyanurate insulation shall be a minimum of 48 kg/m<sup>3</sup> (3.0 pcf).

**2.12 ADHESIVE, MASTIC, CEMENT**

- A. Mil. Spec. MIL-A-3316, Class 1: Jacket and lap adhesive and protective finish coating for insulation.
- B. Mil. Spec. MIL-A-3316, Class 2: Adhesive for laps and for adhering insulation to metal surfaces.
- C. Mil. Spec. MIL-A-24179, Type II Class 1: Adhesive for installing flexible unicellular insulation and for laps and general use.
- D. Mil. Spec. MIL-C-19565, Type I: Protective finish for outdoor use.
- E. Mil. Spec. MIL-C-19565, Type I or Type II: Vapor barrier compound for indoor use.
- F. ASTM C449: Mineral fiber hydraulic-setting thermal insulating and finishing cement.
- G. Other: Insulation manufacturers' published recommendations.

**2.13 MECHANICAL FASTENERS**

- A. Pins, anchors: Welded pins, or metal or nylon anchors with galvanized steel-coated or fiber washer, or clips. Pin diameter shall be as recommended by the insulation manufacturer.
- B. Staples: Outward clinching monel or galvanized steel.
- C. Wire: 1.3 mm thick (18 gage) soft annealed galvanized or 1.9 mm (14 gage) copper clad steel or nickel copper alloy.
- D. Bands: 13 mm (0.5 inch) nominal width, brass, galvanized steel, aluminum or stainless steel.

**2.14 REINFORCEMENT AND FINISHES**

- A. Glass fabric, open weave: ASTM D1668, Type III (resin treated) and Type I (asphalt treated).
- B. Glass fiber fitting tape: Mil. Spec MIL-C-20079, Type II, Class 1.
- C. Tape for Flexible Elastomeric Cellular Insulation: As recommended by the insulation manufacturer.
- D. Hexagonal wire netting: 25 mm (one inch) mesh, 0.85 mm thick (22 gage) galvanized steel.

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- E. Corner beads: 50 mm (2 inch) by 50 mm (2 inch), 0.55 mm thick (26 gage) galvanized steel; or, 25 mm (1 inch) by 25 mm (1 inch), 0.47 mm thick (28 gage) aluminum angle adhered to 50 mm (2 inch) by 50 mm (2 inch) Kraft paper.
- F. PVC fitting cover: Fed. Spec L-P-535, Composition A, 11-86 Type II, Grade GU, with Form B Mineral Fiber insert, for media temperature 4 degrees C (40 degrees F) to 121 degrees C (250 degrees F). Below 4 degrees C (40 degrees F) and above 121 degrees C (250 degrees F). Provide double layer insert. Provide color matching vapor barrier pressure sensitive tape.

**2.15 FIRESTOPPING MATERIAL**

Other than pipe and duct insulation, refer to Section 07 84 00  
FIRESTOPPING.

**2.16 FLAME AND SMOKE**

Unless shown otherwise all assembled systems shall meet flame spread 25 and smoke developed 50 rating as developed under ASTM, NFPA and UL standards and specifications. See paragraph 1.3 "Quality Assurance".

**PART 3 - EXECUTION**

**3.1 GENERAL REQUIREMENTS**

- A. Required pressure tests of duct and piping joints and connections shall be completed and the work approved by the Resident Engineer for application of insulation. Surface shall be clean and dry with all foreign materials, such as dirt, oil, loose scale and rust removed.
- B. Except for specific exceptions, insulate entire specified equipment, piping (pipe, fittings, valves, accessories), and duct systems. Insulate each pipe and duct individually. Do not use scrap pieces of insulation where a full length section will fit.
- C. Where removal of insulation of piping, ductwork and equipment is required to comply with Section 02 82 11, TRADITIONAL ASBESTOS ABATEMENT and Section 02 82 13.13, GLOVEBAG ASBESTOS ABATEMENT, such areas shall be reinsulated to comply with this specification.
- D. Insulation materials shall be installed in a first class manner with smooth and even surfaces, with jackets and facings drawn tight and smoothly cemented down at all laps. Insulation shall be continuous through all sleeves and openings, except at fire dampers and duct heaters (NFPA 90A). Vapor retarders shall be continuous and uninterrupted throughout systems with operating temperature 16 degrees

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- C (60 degrees F) and below. Lap and seal vapor retarder over ends and exposed edges of insulation. Anchors, supports and other metal projections through insulation on cold surfaces shall be insulated and vapor sealed for a minimum length of 150 mm (6 inches).
- E. Install vapor stops at all insulation terminations on either side of valves, pumps and equipment and particularly in straight lengths of pipe insulation.
- F. Construct insulation on parts of equipment such as pumps , convertors and heat exchangers that must be opened periodically for maintenance or repair, so insulation can be removed and replaced without damage. Install insulation with bolted 1 mm thick (20 gage) galvanized steel or aluminum covers as complete units, or in sections, with all necessary supports, and split to coincide with flange/split of the equipment.
- G. Insulation on hot piping and equipment shall be terminated square at items not to be insulated, access openings and nameplates. Cover all exposed raw insulation with white sealer or jacket material.
- H. Protect all insulations outside of buildings with aluminum jacket using lock joint or other approved system for a continuous weather tight system. Access doors and other items requiring maintenance or access shall be removable and sealable.
- I. Insulate PRVs, flow meters, and steam traps.
- J. HVAC work not to be insulated:
1. Internally insulated ductwork and air handling units.
  2. Relief air ducts (Economizer cycle exhaust air).
  3. Exhaust air ducts and plenums, and ventilation exhaust air shafts.
  4. Equipment: Expansion tanks, flash tanks, hot water pumps.
  5. In hot piping: Unions, flexible connectors, control valves, PRVs, safety valves and discharge vent piping, vacuum breakers, thermostatic vent valves, steam traps 20 mm (3/4 inch) and smaller, exposed piping through floor for convectors and radiators. Insulate piping to within approximately 75 mm (3 inches) of uninsulated items.
- K. Apply insulation materials subject to the manufacturer's recommended temperature limits. Apply adhesives, mastic and coatings at the manufacturer's recommended minimum coverage.
- L. Elbows, flanges and other fittings shall be insulated with the same material as is used on the pipe straights. The elbow/ fitting

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insulation shall be field-fabricated, mitered or factory prefabricated to the necessary size and shape to fit on the elbow/ fitting. Use of polyurethane spray-foam to fill a PVC elbow jacket is prohibited on cold applications.

**M. Firestop Pipe and Duct insulation:**

1. Provide firestopping insulation at fire and smoke barriers through penetrations. Fire stopping insulation shall be UL listed as defines in Section 07 84 00, FIRESTOPPING.
2. Pipe and duct penetrations requiring fire stop insulation including, but not limited to the following:
  - a. Pipe risers through floors
  - b. Pipe or duct chase walls and floors
  - c. Smoke partitions
  - d. Fire partitions

**N. Provide vapor barrier jackets over insulation as follows:**

1. All piping and ductwork exposed to outdoor weather.
2. All interior piping and ducts conveying fluids //exposed to outdoor air (i.e. in attics, ventilated (not air conditioned) spaces, etc.) below ambient air temperature in high humidity areas.

**O. Provide metal jackets over insulation as follows:**

1. All piping and ducts exposed to outdoor weather.
2. Piping exposed in building, within 1800 mm (6 feet) of the floor, that connects to sterilizers, kitchen and laundry equipment. Jackets may be applied with pop rivets. Provide aluminum angle ring escutcheons at wall, ceiling or floor penetrations.
3. A 50 mm (2 inch) overlap is required at longitudinal and circumferential joints.

**3.2 INSULATION INSTALLATION**

**A. Mineral Fiber Board:**

1. Faced board: Apply board on pins spaced not more than 300 mm (12 inches) on center each way, and not less than 75 mm (3 inches) from each edge of board. In addition to pins, apply insulation bonding adhesive to entire underside of horizontal metal surfaces. Butt insulation edges tightly and seal all joints with laps and butt strips. After applying speed clips cut pins off flush and apply vapor seal patches over clips.
2. Plain board:

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- a. Insulation shall be scored, beveled or mitered to provide tight joints and be secured to equipment with bands spaced 225 mm (9 inches) on center for irregular surfaces or with pins and clips on flat surfaces. Use corner beads to protect edges of insulation.
  - b. For hot equipment: Stretch 25 mm (1 inch) mesh wire, with edges wire laced together, over insulation and finish with insulating and finishing cement applied in one coat, 6 mm (1/4 inch) thick, trowel led to a smooth finish.
  - c. For cold equipment: Apply meshed glass fabric in a tack coat 1.5 to 1.7 square meter per liter (60 to 70 square feet per gallon) of vapor mastic and finish with mastic at 0.3 to 0.4 square meter per liter (12 to 15 square feet per gallon) over the entire fabric surface.
3. Exposed, unlined ductwork and equipment in unfinished areas, mechanical and electrical equipment rooms and attics, and duct work exposed to outdoor weather:
  - a. 40 mm (1-1/2 inch) thick insulation faced with ASJ (white all service jacket): Supply air duct.
  - b. 40 mm (1-1/2 inch) thick insulation faced with ASJ: Return air duct, mixed air plenums and prefilter housing.
  - c. Outside air intake ducts: 25 mm (one inch) thick insulation faced with ASJ.
4. Cold equipment: 40 mm (1-1/2 inch) thick insulation faced with ASJ.
5. Hot equipment: 40 mm (1-1/2 inch) thick insulation faced with ASJ.
  - a. Convertors, air separators, steam condensate pump receivers.
  - b. Reheat coil casing and steam generators humidifiers.
  - c. Domestic water heaters and hot water storage tanks (not factory insulated).
  - d. Booster water heaters for dietetics dish and pot washers and for washdown grease-extracting hoods.
- B. Flexible Mineral Fiber Blanket:
  1. Adhere insulation to metal with 75 mm (3 inch) wide strips of insulation bonding adhesive at 200 mm (8 inches) on center all around duct. Additionally secure insulation to bottom of ducts exceeding 600 mm (24 inches) in width with pins welded or adhered on

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450 mm (18 inch) centers. Secure washers on pins. Butt insulation edges and seal joints with laps and butt strips. Staples may be used to assist in securing insulation. Seal all vapor retarder penetrations with mastic. Sagging duct insulation will not be acceptable. Install firestop duct insulation where required.

2. Supply air ductwork to be insulated includes main and branch ducts from AHU discharge to room supply outlets, and the bodies of ceiling outlets to prevent condensation. Insulate sound attenuator units, coil casings and damper frames. To prevent condensation insulate trapeze type supports and angle iron hangers for flat oval ducts that are in direct contact with metal duct.
3. Concealed supply air ductwork.
  - a. Above ceilings for other than roof level: 40 mm (1 ½ inch) thick insulation faced with FSK.
4. Concealed return air duct:
  - a. Concealed return and exhaust air ductwork in other locations need not be insulated.
5. Concealed outside air duct: 40 mm (1-1/2 inch) thick insulation faced with FSK.

**C. Molded Mineral Fiber Pipe and Tubing Covering:**

1. Fit insulation to pipe or duct, aligning longitudinal joints. Seal longitudinal joint laps and circumferential butt strips by rubbing hard with a nylon sealing tool to assure a positive seal. Staples may be used to assist in securing insulation. Seal all vapor retarder penetrations on cold piping with a generous application of vapor barrier mastic. Provide inserts and install with metal insulation shields at outside pipe supports. Install freeze protection insulation over heating cable.
2. Contractor's options for fitting, flange and valve insulation:
  - a. Insulating and finishing cement for sizes less than 100 mm (4 inches) operating at surface temperature of 16 degrees C (61 degrees F) or more.
  - b. Factory premolded, one piece PVC covers with mineral fiber, (Form B), inserts. Provide two insert layers for pipe temperatures below 4 degrees C (40 degrees F), or above 121 degrees C (250 degrees F). Secure first layer of insulation with twine. Seal

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seam edges with vapor barrier mastic and secure with fitting tape.

- c. Factory molded, ASTM C547 or field mitered sections, joined with adhesive or wired in place. For hot piping finish with a smoothing coat of finishing cement. For cold fittings, 16 degrees C (60 degrees F) or less, vapor seal with a layer of glass fitting tape imbedded between two 2 mm (1/16 inch) coats of vapor barrier mastic.
  - d. Fitting tape shall extend over the adjacent pipe insulation and overlap on itself at least 50 mm (2 inches).
3. Nominal thickness in millimeters and inches specified in the schedule at the end of this section.

**D. Rigid Cellular Phenolic Foam:**

- 1. Rigid closed cell phenolic insulation may be provided for piping, ductwork and equipment for temperatures up to 121 degrees C (250 degrees F).
- 2. Note the NFPA 90A burning characteristics requirements of 25/50 in paragraph 1.3.B
- 3. Provide secure attachment facilities such as welding pins.
- 4. Apply insulation with joints tightly drawn together
- 5. Apply adhesives, coverings, neatly finished at fittings, and valves.
- 6. Final installation shall be smooth, tight, neatly finished at all edges.
- 7. Minimum thickness in millimeters (inches) specified in the schedule at the end of this section.
- 8. Exposed, unlined supply and return ductwork exposed to outdoor weather: 50 mm (2 inch) thick insulation faced with a multi-layer vapor barrier with a maximum water vapor permeance of 0.00 perms.
- 9. Condensation control insulation: Minimum 25 mm (1.0 inch) thick for all pipe sizes.
  - a. HVAC: Cooling coil condensation piping to waste piping fixture or drain inlet. Omit insulation on plastic piping in mechanical rooms.

**E. Cellular Glass Insulation:**

- 1. Pipe and tubing, covering nominal thickness in millimeters and inches as specified in the schedule at the end of this section.
- 2. Cold equipment: 50 mm (2 inch) thick insulation faced with ASJ .



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**F. Flexible Elastomeric Cellular Thermal Insulation:**

1. Apply insulation and fabricate fittings in accordance with the manufacturer's installation instructions and finish with two coats of weather resistant finish as recommended by the insulation manufacturer.
2. Pipe and tubing insulation:
  - a. Use proper size material. Do not stretch or strain insulation.
  - b. To avoid undue compression of insulation, provide cork stoppers or wood inserts at supports as recommended by the insulation manufacturer. Insulation shields are specified under Section 23 05 11, COMMON WORK RESULTS FOR HVAC //and Section 23 05 10, COMMON WORK RESULTS FOR BOILER PLANT and STEAM GENERATION//.
  - c. Where possible, slip insulation over the pipe or tubing prior to connection, and seal the butt joints with adhesive. Where the slip-on technique is not possible, slit the insulation and apply it to the pipe sealing the seam and joints with contact adhesive. Optional tape sealing, as recommended by the manufacturer, may be employed. Make changes from mineral fiber insulation in a straight run of pipe, not at a fitting. Seal joint with tape.
3. Apply sheet insulation to flat or large curved surfaces with 100 percent adhesive coverage. For fittings and large pipe, apply adhesive to seams only.
4. Pipe insulation: nominal thickness in millimeters (inches as specified in the schedule at the end of this section.
5. Minimum 20 mm (0.75 inch) thick insulation for pneumatic control lines for a minimum distance of 6 m (20 feet) from discharge side of the refrigerated dryer.

**3.3 PIPE INSULATION SCHEDULE**

Provide insulation for piping systems as scheduled below:

<b>Insulation Thickness Millimeters (Inches)</b>					
		Nominal Pipe Size Millimeters (Inches)			
Operating Temperature Range/Service	Insulation Material	Less than 25 (1)	25 - 32 (1 - 1¼)	38 - 75 (1½ - 3)	100 (4) and Above
122-177 degrees C (251-350 degrees F)	Mineral Fiber (Above ground piping only)	75 (3)	100 (4)	113 (4.5)	113 (4.5)

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(HPS, MPS)					
93-260 degrees C (200-500 degrees F) (HPS, HPR)	Calcium Silicate	100 (4)	125 (5)	150 (6)	150 (6)
100-121 degrees C (212-250 degrees F) (HPR, MPR, LPS, vent piping from PRV Safety Valves, Condensate receivers and flash tanks)	Mineral Fiber (Above ground piping only)	62 (2.5)	62 (2.5)	75 (3.0)	75 (3.0)
100-121 degrees C (212-250 degrees F) (HPR, MPR, LPS, vent piping from PRV Safety Valves, Condensate receivers and flash tanks)	Rigid Cellular Phenolic Foam	50 (2.0)	50 (2.0)	75 (3.0)	75 (3.0)
38-94 degrees C (100-200 degrees F) (LPR, PC, HWH, HWHR, GH and GHR)	Mineral Fiber (Above ground piping only)	38 (1.5)	38 (1.5)	50 (2.0)	50 (2.0)
38-99 degrees C (100-211 degrees F) (LPR, PC, HWH, HWHR, GH and GHR)	Rigid Cellular Phenolic Foam	38 (1.5)	38 (1.5)	50 (2.0)	50 (2.0)
38-94 degrees C (100-200 degrees F) (LPR, PC, HWH, HWHR, GH and GHR)	Flexible Elastomeric Cellular Thermal (Above ground piping only)	38 (1.5)	38 (1.5)	----	----
4-16 degrees C (40-60 degrees F) (CH, CHR, GC, GCR and RS for DX refrigeration)	Rigid Cellular Phenolic Foam	38 (1.5)	38 (1.5)	38 (1.5)	38 (1.5)
4-16 degrees C (40-60 degrees F)	Cellular Glass Closed-Cell	50 (2.0)	50 (2.0)	75 (3.0)	75 (3.0)

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(CH and CHR within chiller room and pipe chase and underground)					
4-16 degrees C (40-60 degrees F) (CH, CHR, GC, GCR and RS for DX refrigeration)	Cellular Glass Closed-Cell	38 (1.5)	38 (1.5)	38 (1.5)	38 (1.5)
(40-60 degrees F) (CH, CHR, GC, GCR and RS for DX refrigeration)	Flexible Elastomeric Cellular Thermal (Above ground piping only)	38 (1.5)	38 (1.5)	38 (1.5)	38 (1.5)

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SECTION 23 09 23

DIRECT-DIGITAL THERMO-MECHANICAL, AND ELECTRIC CONTROL SYSTEMS FOR HVAC

PART 1 - GENERAL

1.1 DESCRIPTION

- A. In addition to direct digital controls (DDC) also include as indicated herein, thermo-mechanical controls for convectors, as well as electric controls for the induction units.
  - B. Provide (a) direct-digital control system (DDC) as indicated on the project documents, point list, interoperability tables, drawings and as described in these specifications. The new direct digital control (DDC) system, associated equipment and components shall be by Automated Logic, connecting to and expanding the existing campus DDC systems into a single, cohesive system. Include a complete and working direct-digital control system. Include all engineering, programming, controls and installation materials, installation labor, commissioning and start-up, training, final project documentation and warranty.
- 1. The direct-digital control system) shall consist of high-speed, peer-to-peer network of DDC controllers. Provide a remote user using a standard web browser to access the control system graphics and change adjustable setpoints with the proper password.
  - 2. The direct-digital control system(s) shall be native BACnet. All new controllers, devices and components shall be listed by BACnet Testing Laboratories. All new controller, devices and components shall be accessible using a Web browser interface and shall communicate exclusively using the ASHRAE Standard 135 BACnet communications protocol without the use of gateways, unless otherwise allowed by this Section of the technical specifications, specifically shown on the design drawings and specifically requested otherwise by the VA.

The work administered by this Section of the technical specifications shall include all labor, materials, special tools, equipment, enclosures, power supplies, software, software licenses, Project specific software configurations and database entries, interfaces, wiring, tubing, installation, labeling, engineering, calibration, documentation, submittals, testing, verification, training services, permits and licenses, transportation, shipping, handling,

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administration, supervision, management, insurance, Warranty, specified services and items required for complete and fully functional Controls Systems.

3. The control systems shall be designed such that each mechanical system shall operate under stand-alone mode. The contractor administered by this Section of the technical specifications shall provide controllers for each mechanical system. In the event of a network communication failure, or the loss of any other controller, the control system shall continue to operate independently. Failure of the ECC shall have no effect on the field controllers, including those involved with global strategies.

- B. Some products are furnished but not installed by the contractor administered by this Section of the technical specifications. The contractor administered by this Section of the technical specifications shall formally coordinate in writing and receive from other contractors formal acknowledgements in writing prior to submission the installation of the products. These products include the following:

1. Control valves.
2. Flow switches.
3. Flow meters.
4. Sensor wells and sockets in piping.
5. Terminal unit controllers.

- C. Some products are installed but not furnished by the contractor administered by this Section of the technical specifications. The contractor administered by this Section of the technical specifications shall formally coordinate in writing and receive from other contractors formal acknowledgements in writing prior to submission the procurement of the products. These products include the following:

- D. Some products are not provided by, but are nevertheless integrated with the work executed by, the contractor administered by this Section of the technical specifications. The contractor administered by this Section of the technical specifications shall formally coordinate in writing and receive from other contractors formal acknowledgements in writing prior to submission the particulars of the products. These products include the following:

1. Fire alarm systems. If zoned fire alarm is required by the project-specific requirements, this interface shall require multiple relays,

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which are provided and installed by the fire alarm system contractor,  
to be monitored.

E. Responsibility Table:

<b>Work/Item/System</b>	<b>Furnish</b>	<b>Install</b>	<b>Low Voltage Wiring</b>	<b>Line Power</b>
Control system low voltage and communication wiring	23 09 23	23 09 23	23 09 23	N/A
Terminal units	23	23	N/A	26
Controllers for terminal units	23 09 23	23	23 09 23	16
LAN conduits and raceway	23 09 23	23 09 23	N/A	N/A
Automatic dampers (not furnished with equipment)	23 09 23	23	N/A	N/A
Automatic damper actuators	23 09 23	23 09 23	23 09 23	23 09 23
Manual valves	23	23	N/A	N/A
Automatic valves	23 09 23	23	23 09 23	23 09 23
Pipe insertion devices and taps, flow and pressure stations.	23	23	N/A	N/A
Thermowells	23 09 23	23	N/A	N/A
Current Switches	23 09 23	23 09 23	23 09 23	N/A
Control Relays	23 09 23	23 09 23	23 09 23	N/A
Power distribution system monitoring interfaces	23 09 23	23 09 23	23 09 23	26
All control system nodes, equipment, housings, enclosures and panels.	23 09 23	23 09 23	23 09 23	26
Smoke detectors	28 31 00	28 31 00	28 31 00	28 31 00
Fire/Smoke Dampers	23	23	28 31 00	28 31 00
Smoke Dampers	23	23	28 31 00	28 31 00
Fire Dampers	23	23	N/A	N/A
Water treatment system	23	23	23	26
VFDs/VSDS	23 09 23	26	23 09 23	26
Medical gas panels	23	23	26	26
Control system interface with CRU A/C controls	23 09 23	23 09 23	23 09 23	26
CRU A/C unit controls interface with control system	23	23 09 23	23 09 23	26

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Work/Item/System	Furnish	Install	Low Voltage Wiring	Line Power
Fire Alarm shutdown relay interlock wiring	28	28	28	26
Control system monitoring of fire alarm smoke control relay	28	28	23 09 23	28
Fire-fighter's smoke control station (FSCS	28	28	28	28
Fan Coil Unit controls (not furnished with equipment)	23 09 23	23 09 23	23 09 23	26
Packaged CSG unit-mounted controls (not furnished with equipment)	23 09 23	23 09 23	23 09 23	26
Starters, HOA switches	23	23	N/A	26

F. This facility's existing direct-digital control system is manufactured by Automated Logic ( Integrated Controls Environmental, LLC) and its ECC is located at Chiller Plant. The existing Automated Logic DDC system will be expanded to accommodate the new scope of work. The contractor administered by this Section of the technical specifications shall observe the capabilities, communication network, services, spare capacity of the existing control system and its ECC prior to beginning work.

a. The combined system shall operate and function as one complete system including one database of control point objects and global control logic capabilities. Facility operators shall have complete operations and control capability over all systems, new and existing including; monitoring, trending, graphing, scheduling, alarm management, global point sharing, global strategy deployment, graphical operations interface and custom reporting as specified.

G. The General Contractor of this project shall directly hire the Control System Integrator in a contract separate from the contract procuring the controls contractor administered by this Section of the technical specifications.

1. The contractor administered by this Section of the technical specifications shall coordinate all work with the Control System Integrator. The contractor administered by this Section of the



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technical specifications shall integrate the ASHRAE Standard 135, BACnet/IP control network(s) with the Control System Integrator's area control through an Ethernet connection provided by the Control System Integrator.

2. The contractor administered by this Section of the technical specifications shall provide a peer-to-peer networked, stand-alone, distributed control system. This direct digital control (DDC) system shall include one portable operator terminal - laptop, one digital display unit, microprocessor-based controllers, instrumentation, end control devices, wiring, piping, software, and related systems. This contractor is responsible for all device mounting and wiring.

3. Responsibility Table:

Item/Task	Section 23 09 23 contractor	Control system integrator	VA
ECC expansion		X	
ECC programming		X	
Devices, controllers, control panels and equipment	X		
Point addressing: all hardware and software points including setpoint, calculated point, data point(analog/binary), and reset schedule point	X		
Point mapping		X	
Network Programming	X		
ECC Graphics		X	
Controller programming and sequences	X		
Integrity of LAN communications	X		
Electrical wiring	X		
Operator system training		X	
LAN connections to devices	X		
LAN connections to ECC		X	
IP addresses			X
Overall system verification		X	
Controller and LAN system verification	X		

- H. Unitary standalone systems including induction units and convectors, and similar units for control of room environment conditions may be equipped with integral controls furnished and installed by the equipment manufacturer or field mounted. Refer to equipment specifications and as indicated in project documents. Application of standalone unitary controls is limited to at least those systems wherein remote monitoring, alarm and start-up are not necessary.
- I. The direct-digital control system shall start and stop equipment, move (position) damper actuators and valve actuators, and vary speed of

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equipment to execute the mission of the control system. Use electricity as the motive force for all damper and valve actuators, unless use of pneumatics as motive force is specifically granted by the VA.

**1.2 RELATED WORK**

- A. Section 21 05 11, Common Work Results for Fire Suppression.
- B. Section 23 09 11, Instrumentation and Control for Boiler Plant.
- C. Section 23 21 13, Hydronic Piping.
- D. Section 23 22 13, Steam and Condensate Heating Piping.
- E. Section 23 31 00, HVAC Ducts and Casings.
- F. Section 23 36 00, Air Terminal Units.
- G. Section 23 73 00, Indoor Central-Station Air-Handling Units.
- H. Section 23 84 00, Humidity Control Equipment.
- I. Section 26 05 11, Requirements for Electrical Installations.
- J. Section 26 05 21, Low-Voltage Electrical Power Conductors and Cables (600 Volts and Below).
- K. Section 26 05 26, Grounding and Bonding for Electrical Systems.
- L. Section 26 05 33, Raceway and Boxes for Electrical Systems.
- M. Section 26 27 26, Wiring Devices.
- N. Section 26 29 11, Motor Starters.
- O. Section 27 15 00, Communications Horizontal Cabling
- P. Section 28 31 00, Fire Detection and Alarm.

**1.3 DEFINITION**

- A. Algorithm: A logical procedure for solving a recurrent mathematical problem; A prescribed set of well-defined rules or processes for the solution of a problem in a finite number of steps.
- B. ARCNET: ANSI/ATA 878.1 - Attached Resource Computer Network. ARCNET is a deterministic LAN technology; meaning it's possible to determine the maximum delay before a device is able to transmit a message.
- C. Analog: A continuously varying signal value (e.g., temperature, current, velocity etc.
- D. BACnet: A Data Communication Protocol for Building Automation and Control Networks , ANSI/ASHRAE Standard 135. This communications protocol allows diverse building automation devices to communicate data over and services over a network.
- E. BACnet/IP: Annex J of Standard 135. It defines and allows for using a reserved UDP socket to transmit BACnet messages over IP networks. A

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BACnet/IP network is a collection of one or more IP sub-networks that share the same BACnet network number.

- F. BACnet Internetwork: Two or more BACnet networks connected with routers. The two networks may use different LAN technologies.
- G. BACnet Network: One or more BACnet segments that have the same network address and are interconnected by bridges at the physical and data link layers.
- H. BACnet Segment: One or more physical segments of BACnet devices on a BACnet network, connected at the physical layer by repeaters.
- I. BACnet Broadcast Management Device (BBMD): A communications device which broadcasts BACnet messages to all BACnet/IP devices and other BBMDs connected to the same BACnet/IP network.
- J. BACnet Interoperability Building Blocks (BIBBs): BACnet Interoperability Building Blocks (BIBBs) are collections of one or more BACnet services. These are prescribed in terms of an "A" and a "B" device. Both of these devices are nodes on a BACnet internetwork.
- K. BACnet Testing Laboratories (BTL). The organization responsible for testing products for compliance with the BACnet standard, operated under the direction of BACnet International.
- L. Baud: It is a signal change in a communication link. One signal change can represent one or more bits of information depending on type of transmission scheme. Simple peripheral communication is normally one bit per Baud. (e.g., Baud rate = 78,000 Baud/sec is 78,000 bits/sec, if one signal change = 1 bit).
- M. Binary: A two-state system where a high signal level represents an "ON" condition and an "OFF" condition is represented by a low signal level.
- N. BMP or bmp: Suffix, computerized image file, used after the period in a DOS-based computer file to show that the file is an image stored as a series of pixels.
- O. Bus Topology: A network topology that physically interconnects workstations and network devices in parallel on a network segment.
- P. Control Unit (CU): Generic term for any controlling unit, stand-alone, microprocessor based, digital controller residing on secondary LAN or Primary LAN, used for local controls or global controls
- Q. Deadband: A temperature range over which no heating or cooling is supplied, i.e., 22-25 degrees C (72-78 degrees F), as opposed to a single point change over or overlap).

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- R. Device: a control system component that contains a BACnet Device Object and uses BACnet to communicate with other devices.
- S. Device Object: Every BACnet device requires one Device Object, whose properties represent the network visible properties of that device. Every Device Object requires a unique Object Identifier number on the BACnet internetwork. This number is often referred to as the device instance.
- T. Device Profile: A specific group of services describing BACnet capabilities of a device, as defined in ASHRAE Standard 135-2008, Annex L. Standard device profiles include BACnet Operator Workstations (B-OWS), BACnet Building Controllers (B-BC), BACnet Advanced Application Controllers (B-AAC), BACnet Application Specific Controllers (B-ASC), BACnet Smart Actuator (B-SA), and BACnet Smart Sensor (B-SS). Each device used in new construction is required to have a PICS statement listing which service and BIBBs are supported by the device.
- U. Diagnostic Program: A software test program, which is used to detect and report system or peripheral malfunctions and failures. Generally, this system is performed at the initial startup of the system.
- V. Direct Digital Control (DDC): Microprocessor based control including Analog/Digital conversion and program logic. A control loop or subsystem in which digital and analog information is received and processed by a microprocessor, and digital control signals are generated based on control algorithms and transmitted to field devices in order to achieve a set of predefined conditions.
- W. Distributed Control System: A system in which the processing of system data is decentralized and control decisions can and are made at the subsystem level. System operational programs and information are provided to the remote subsystems and status is reported back to the Engineering Control Center. Upon the loss of communication with the Engineering Control center, the subsystems shall be capable of operating in a stand-alone mode using the last best available data.
- X. Download: The electronic transfer of programs and data files from a central computer or operation workstation with secondary memory devices to remote computers in a network (distributed) system.
- Y. DXF: An AutoCAD 2-D graphics file format. Many CAD systems import and export the DXF format for graphics interchange.

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- Z. Electrical Control: A control circuit that operates on line or low voltage and uses a mechanical means, such as a temperature sensitive bimetal or bellows, to perform control functions, such as actuating a switch or positioning a potentiometer.
- AA. Electronic Control: A control circuit that operates on low voltage and uses a solid-state components to amplify input signals and perform control functions, such as operating a relay or providing an output signal to position an actuator.
- BB. Engineering Control Center (ECC): The centralized control point for the intelligent control network. The ECC comprises of personal computer and connected devices to form a single workstation.
- CC. Ethernet: A trademark for a system for exchanging messages between computers on a local area network using coaxial, fiber optic, or twisted-pair cables.
- DD. Firmware: Firmware is software programmed into read only memory (ROM) chips. Software may not be changed without physically altering the chip.
- EE. Gateway: Communication hardware connecting two or more different protocols. It translates one protocol into equivalent concepts for the other protocol. In BACnet applications, a gateway has BACnet on one side and non-BACnet (usually proprietary) protocols on the other side.
- FF. GIF: Abbreviation of Graphic interchange format.
- GG. Graphic Program (GP): Program used to produce images of air handler systems, fans, chillers, pumps, and building spaces. These images can be animated and/or color-coded to indicate operation of the equipment.
- HH. Graphic Sequence of Operation: It is a graphical representation of the sequence of operation, showing all inputs and output logical blocks.
- II. I/O Unit: The section of a digital control system through which information is received and transmitted. I/O refers to analog input (AI, digital input (DI), analog output (AO) and digital output (DO). Analog signals are continuous and represent temperature, pressure, flow rate etc, whereas digital signals convert electronic signals to digital pulses (values), represent motor status, filter status, on-off equipment etc.
- JJ. I/P: a method for conveying and routing packets of information over LAN paths. User Datagram Protocol (UDP) conveys information to "sockets" without confirmation of receipt. Transmission Control Protocol (TCP)

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establishes "sessions", which have end-to-end confirmation and guaranteed sequence of delivery.

- KK. JPEG: A standardized image compression mechanism stands for Joint Photographic Experts Group, the original name of the committee that wrote the standard.
- LL. Local Area Network (LAN): A communication bus that interconnects operator workstation and digital controllers for peer-to-peer communications, sharing resources and exchanging information.
- MM. Network Repeater: A device that receives data packet from one network and rebroadcasts to another network. No routing information is added to the protocol.
- NN. MS/TP: Master-slave/token-passing (ISO/IEC 8802, Part 3). It is not an acceptable LAN option for VA health-care facilities. It uses twisted-pair wiring for relatively low speed and low cost communication.
- OO. Native BACnet Device: A device that uses BACnet as its primary method of communication with other BACnet devices without intermediary gateways. A system that uses native BACnet devices at all levels is a native BACnet system.
- PP. Network Number: A site-specific number assigned to each network segment to identify for routing. This network number must be unique throughout the BACnet internetwork.
- QQ. Object: The concept of organizing BACnet information into standard components with various associated properties. Examples include analog input objects and binary output objects.
- RR. Object Identifier: An object property used to identify the object, including object type and instance. Object Identifiers must be unique within a device.
- SS. Object Properties: Attributes of an object. Examples include present value and high limit properties of an analog input object. Properties are defined in ASHRAE 135; some are optional and some are required. Objects are controlled by reading from and writing to object properties.
- TT. Operating system (OS): Software, which controls the execution of computer application programs.
- UU. PCX: File type for an image file. When photographs are scanned onto a personal computer they can be saved as PCX files and viewed or changed by a special application program as Photo Shop.

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- VV. Peripheral: Different components that make the control system function as one unit. Peripherals include monitor, printer, and I/O unit.
- WW. Peer-to-Peer: A networking architecture that treats all network stations as equal partners- any device can initiate and respond to communication with other devices.
- XX. PICS: Protocol Implementation Conformance Statement, describing the BACnet capabilities of a device. All BACnet devices have published PICS.
- YY. PID: Proportional, integral, and derivative control, used to control modulating equipment to maintain a setpoint.
- ZZ. Repeater: A network component that connects two or more physical segments at the physical layer.
- AAA. Router: a component that joins together two or more networks using different LAN technologies. Examples include joining a BACnet Ethernet LAN to a BACnet MS/TP LAN.
- BBB. Sensors: devices measuring state points or flows, which are then transmitted back to the DDC system.
- CCC. Thermostats : devices measuring temperatures, which are used in control of standalone or unitary systems and equipment not attached to the DDC system.

**1.4 QUALITY ASSURANCE**

**A. Criteria:**

1. Single Source Responsibility of subcontractor: The Contractor shall obtain hardware and software supplied under this Section and delegate the responsibility to a single source controls installation subcontractor. The controls subcontractor shall be responsible for the complete design, installation, and commissioning of the system. The controls subcontractor shall be in the business of design, installation and service of such building automation control systems similar in size and complexity.
2. Equipment and Materials: Equipment and materials shall be cataloged products of manufacturers regularly engaged in production and installation of HVAC control systems. Products shall be manufacturer's latest standard design and have been tested and proven in actual use.
3. The controls subcontractor shall provide a list of no less than five similar projects which have building control systems as specified in

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this Section. These projects must be on-line and functional such that the Department of Veterans Affairs (VA) representative would observe the control systems in full operation.

4. The controls subcontractor shall have in-place facility within 50 miles with technical staff, spare parts inventory for the next five (5) years, and necessary test and diagnostic equipment to support the control systems.
5. The controls subcontractor shall have minimum of three years experience in design and installation of building automation systems similar in performance to those specified in this Section. Provide evidence of experience by submitting resumes of the project manager, the local branch manager, project engineer, the application engineering staff, and the electronic technicians who would be involved with the supervision, the engineering, and the installation of the control systems. Training and experience of these personnel shall not be less than three years. Failure to disclose this information will be a ground for disqualification of the supplier.
6. Provide a competent and experienced Project Manager employed by the Controls Contractor. The Project Manager shall be supported as necessary by other Contractor employees in order to provide professional engineering, technical and management service for the work. The Project Manager shall attend scheduled Project Meetings as required and shall be empowered to make technical, scheduling and related decisions on behalf of the Controls Contractor.

**B. Codes and Standards:**

1. All work shall conform to the applicable Codes and Standards.
2. Electronic equipment shall conform to the requirements of FCC Regulation, Part 15, Governing Radio Frequency Electromagnetic Interference, and be so labeled.

**1.5 PERFORMANCE**

**A. The system shall conform to the following:**

1. Graphic Display: The system shall display up to four (4) graphics on a single screen with a minimum of twenty (20) dynamic points per graphic. All current data shall be displayed within ten (10) seconds of the request.



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2. Graphic Refresh: The system shall update all dynamic points with current data within eight (8) seconds. Data refresh shall be automatic, without operator intervention.
3. Object Command: The maximum time between the command of a binary object by the operator and the reaction by the device shall be two(2) seconds. Analog objects shall start to adjust within two (2) seconds.
4. Object Scan: All changes of state and change of analog values shall be transmitted over the high-speed network such that any data used or displayed at a controller or work-station will be current, within the prior six (6) seconds.
5. Alarm Response Time: The maximum time from when an object goes into alarm to when it is annunciated at the workstation shall not exceed (10) seconds.
6. Program Execution Frequency: Custom and standard applications shall be capable of running as often as once every (5) seconds. The Contractor shall be responsible for selecting execution times consistent with the mechanical process under control.
7. Multiple Alarm Annunciations: All workstations on the network shall receive alarms within five (5) seconds of each other.
8. Performance: Programmable Controllers shall be able to execute DDC PID control loops at a selectable frequency from at least once every one (1) second. The controller shall scan and update the process value and output generated by this calculation at this same frequency.
9. Reporting Accuracy: Listed below are minimum acceptable reporting end-to-end accuracies for all values reported by the specified system:

Measured Variable	Reported Accuracy
Space temperature	±0.5°C (±1°F)
Ducted air temperature	±0.5°C [±1°F]
Outdoor air temperature	±1.0°C [±2°F]
Water temperature	±0.5°C [±1°F]
Relative humidity	±2% RH
Water flow	±1% of reading
Air flow (terminal)	±10% of reading

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Air flow (measuring stations)	±5% of reading
Carbon Dioxide (CO <sub>2</sub> )	±50 ppm
Air pressure (ducts)	±25 Pa [±0.1"w.c.]
Air pressure (space)	±0.3 Pa [±0.001"w.c.]
Water pressure	±2% of full scale *Note 1
Electrical Power	±0.5% of reading

Note 1: for both absolute and differential pressure

10. Control stability and accuracy: Control sequences shall maintain measured variable at setpoint within the following tolerances:

Controlled Variable	Control Accuracy	Range of Medium
Air Pressure	±50 Pa (±0.2 in. w.g.)	0-1.5 kPa (0-6 in. w.g.)
Air Pressure	±3 Pa (±0.01 in. w.g.)	-25 to 25 Pa (-0.1 to 0.1 in. w.g.)
Airflow	±10% of full scale	
Space Temperature	±1.0°C (±2.0°F)	
Duct Temperature	±1.5°C (±3°F)	
Humidity	±5% RH	
Fluid Pressure	±10 kPa (±1.5 psi)	0-1 MPa (1-150 psi)
Fluid Pressure	±250 Pa (±1.0 in. w.g.)	0-12.5 kPa (0-50 in. w.g.) differential

11. Extent of direct digital control: control design shall allow for at least the points indicated on the points lists on the drawings.

#### **1.6 WARRANTY**

- A. Labor and materials for control systems shall be warranted for a period as specified under Warranty in FAR clause 52.246-21.
- B. Control system failures during the warranty period shall be adjusted, repaired, or replaced at no cost or reduction in service to the owner. The system includes all computer equipment, transmission equipment, and all sensors and control devices.
- C. The on-line support service shall allow the Controls supplier to dial out over telephone lines to or connect via (through password-limited access) VPN through the internet monitor and control the facility's building automation system. This remote connection to the facility shall be within two (2) hours of the time that the problem is reported. This coverage shall be extended to include normal business hours, after

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business hours, weekend and holidays. If the problem cannot be resolved with on-line support services, the Controls supplier shall dispatch the qualified personnel to the job site to resolve the problem within 24 hours after the problem is reported.

- D. Controls and Instrumentation subcontractor shall be responsible for temporary operations and maintenance of the control systems during the construction period until final commissioning, training of facility operators and acceptance of the project by VA.

**1.7 SUBMITTALS**

- A. Submit shop drawings in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Manufacturer's literature and data for all components including the following:
1. A wiring diagram for each type of input device and output device including DDC controllers, modems, repeaters, etc. Diagram shall show how the device is wired and powered, showing typical connections at the digital controllers and each power supply, as well as the device itself. Show for all field connected devices, including but not limited to, control relays, motor starters, electric or electronic actuators, and temperature pressure, flow and humidity sensors and transmitters.
  2. A diagram of each terminal strip, including digital controller terminal strips, terminal strip location, termination numbers and the associated point names.
  3. Control dampers and control valves schedule, including the size and pressure drop.
  4. Control air-supply components, and computations for sizing compressors, receivers and main air-piping, if pneumatic controls are furnished.
  5. Catalog cut sheets of all equipment used. This includes, but is not limited to software (by manufacturer and by third parties), DDC controllers, panels, peripherals, airflow measuring stations and associated components, and auxiliary control devices such as sensors, actuators, and control dampers. When manufacturer's cut sheets apply to a product series rather than a specific product, the data specifically applicable to the project shall be highlighted. Each submitted piece of literature and drawings should clearly

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- reference the specification and/or drawings that it supposed to represent.
6. Sequence of operations for each HVAC system and the associated control diagrams. Equipment and control labels shall correspond to those shown on the drawings.
  7. Color prints of proposed graphics with a list of points for display.
  8. Furnish a BACnet Protocol Implementation Conformance Statement (PICS) for each BACnet-compliant device.
  9. Schematic wiring diagrams for all control, communication and power wiring. Provide a schematic drawing of the central system installation. Label all cables and ports with computer manufacturers' model numbers and functions. Show all interface wiring to the control system.
  10. An instrumentation list for each controlled system. Each element of the controlled system shall be listed in table format. The table shall show element name, type of device, manufacturer, model number, and product data sheet number.
  11. Riser diagrams of wiring between central control unit and all control panels.
  12. Scaled plan drawings showing routing of LAN and locations of control panels, controllers, routers, gateways, ECC, and larger controlled devices.
  13. Construction details for all installed conduit, cabling, raceway, cabinets, and similar. Construction details of all penetrations and their protection.
  14. Quantities of submitted items may be reviewed but are the responsibility of the contractor administered by this Section of the technical specifications.
- C. Product Certificates: Compliance with Article, QUALITY ASSURANCE.
- D. Licenses: Provide licenses for all software residing on and used by the Controls Systems and transfer these licenses to the Owner prior to completion.
- E. As Built Control Drawings:
1. Furnish three (3) copies of as-built drawings for each control system. The documents shall be submitted for approval prior to final completion.

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2. Furnish one (1) stick set of applicable control system prints for each mechanical system for wall mounting. The documents shall be submitted for approval prior to final completion.
3. Furnish one (1) CD-ROM in CAD DWG and/or .DXF format for the drawings noted in subparagraphs above.

**F. Operation and Maintenance (O/M) Manuals):**

1. Submit in accordance with Article, INSTRUCTIONS, in Specification Section 01 00 00, GENERAL REQUIREMENTS.
2. Include the following documentation:
  - a. General description and specifications for all components, including logging on/off, alarm handling, producing trend reports, overriding computer control, and changing set points and other variables.
  - b. Detailed illustrations of all the control systems specified for ease of maintenance and repair/replacement procedures, and complete calibration procedures.
  - c. One copy of the final version of all software provided including operating systems, programming language, operator workstation software, and graphics software.
  - d. Complete troubleshooting procedures and guidelines for all systems.
  - e. Complete operating instructions for all systems.
  - f. Recommended preventive maintenance procedures for all system components including a schedule of tasks for inspection, cleaning and calibration. Provide a list of recommended spare parts needed to minimize downtime.
  - g. Training Manuals: Submit the course outline and training material to the Owner for approval three (3) weeks prior to the training to VA facility personnel. These persons will be responsible for maintaining and the operation of the control systems, including programming. The Owner reserves the right to modify any or all of the course outline and training material.
  - h. Licenses, guaranty, and other pertaining documents for all equipment and systems.

**G. Submit Performance Report to Resident Engineer prior to final inspection.**

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**1.8 INSTRUCTIONS**

- A. Instructions to VA operations personnel: Perform in accordance with Article, INSTRUCTIONS, in Specification Section 01 00 00, GENERAL REQUIREMENTS, and as noted below. Contractor shall also video tape instruction sessions noted below.
1. First Phase: Formal instructions to the VA facilities personnel for a total of 16 hours, given in multiple training sessions (each no longer than four hours in length), conducted sometime between the completed installation and prior to the performance test period of the control system, at a time mutually agreeable to the Contractor and the VA.
  2. Second Phase: This phase of training shall comprise of on the job training during start-up, checkout period, and performance test period. VA facilities personnel will work with the Contractor's installation and test personnel on a daily basis during start-up and checkout period. During the performance test period, controls subcontractor will provide 8 hours of instructions, given in multiple training sessions (each no longer than four hours in length), to the VA facilities personnel.
  3. The O/M Manuals shall contain approved submittals as outlined in Article 1.7, SUBMITTALS. The Controls subcontractor will review the manual contents with VA facilities personnel during second phase of training.
  4. Training shall be given by direct employees of the controls system subcontractor.

**1.9 PROJECT CONDITIONS (ENVIRONMENTAL CONDITIONS OF OPERATION)**

- A. The ECC and peripheral devices and system support equipment shall be designed to operate in ambient condition of 20 to 35°C (65 to 90°F) at a relative humidity of 20 to 80% non-condensing.
- B. The CUs used outdoors shall be mounted in NEMA 4 waterproof enclosures, and shall be rated for operation at -40 to 65°C (-40 to 150°F).
- C. All electronic equipment shall operate properly with power fluctuations of plus 10 percent to minus 15 percent of nominal supply voltage.
- D. Sensors and controlling devices shall be designed to operate in the environment, which they are sensing or controlling.

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**1.10 APPLICABLE PUBLICATIONS**

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.
- B. American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE):  
Standard 135-10 .....BACNET Building Automation and Control Networks
- C. American Society of Mechanical Engineers (ASME):  
B16.18-01 .....Cast Copper Alloy Solder Joint Pressure Fittings.  
B16.22-01 .....Wrought Copper and Copper Alloy Solder Joint Pressure Fittings.
- D. American Society of Testing Materials (ASTM):  
B32-08 .....Standard Specification for Solder Metal  
B88-09 .....Standard Specifications for Seamless Copper Water Tube  
B88M-09 .....Standard Specification for Seamless Copper Water Tube (Metric)  
B280-08 .....Standard Specification for Seamless Copper Tube for Air-Conditioning and Refrigeration Field Service  
D2737-03 .....Standard Specification for Polyethylene (PE) Plastic Tubing
- E. Federal Communication Commission (FCC):  
Rules and Regulations Title 47 Chapter 1-2001 Part 15: Radio Frequency Devices.
- F. Institute of Electrical and Electronic Engineers (IEEE):  
802.3-11 .....Information Technology-Telecommunications and Information Exchange between Systems-Local and Metropolitan Area Networks- Specific Requirements-Part 3: Carrier Sense Multiple Access with Collision Detection (CSMA/CD) Access method and Physical Layer Specifications
- G. National Fire Protection Association (NFPA):  
70-11 .....National Electric Code  
90A-09 .....Standard for Installation of Air-Conditioning and Ventilation Systems
- H. Underwriter Laboratories Inc (UL):  
94-10 .....Tests for Flammability of Plastic Materials for Parts and Devices and Appliances  
294-10 .....Access Control System Units  
486A/486B-10 .....Wire Connectors  
555S-11 .....Standard for Smoke Dampers  
916-10 .....Energy Management Equipment  
1076-10 .....Proprietary Burglar Alarm Units and Systems

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**PART 2 - PRODUCTS**

**2.1 MATERIALS**

- A. Use new products that the manufacturer is currently manufacturing and that have been installed in a minimum of 25 installations. Spare parts shall be available for at least five years after completion of this contract.

**2.2 CONTROLS SYSTEM ARCHITECTURE**

A. General

- 1. The Controls Systems shall consist of multiple Nodes and associated equipment connected by industry standard digital and communication network arrangements.
- 2. The building controllers and principal communications network equipment shall be standard products of recognized major manufacturers available through normal PC and computer vendor channels - not "Clones" assembled by a third-party subcontractor.
- 3. The networks shall, at minimum, comprise, as necessary, the following:
  - a. A fixed ECC and a portable operator's terminal.
  - b. Network computer processing, data storage and BACnet-compliant communication equipment including Servers and digital data processors.
  - c. BACnet-compliant routers, bridges, switches, hubs, modems, gateways, interfaces and similar communication equipment.
  - d. Active processing BACnet-compliant building controllers connected to other BACnet-compliant controllers together with their power supplies and associated equipment.
  - e. Addressable elements, sensors, transducers and end devices.
  - f. Third-party equipment interfaces and gateways as described and required by the Contract Documents.
  - g. Other components required for a complete and working Control Systems as specified.

- B. The Specifications for the individual elements and component subsystems shall be minimum requirements and shall be augmented as necessary by the Contractor to achieve both compliance with all applicable codes, standards and to meet all requirements of the Contract Documents.



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C. Network Architecture

1. The Controls communication network shall utilize BACnet communications protocol operating over a standard Ethernet LAN and operate at a minimum speed of 100 Mb/sec.
2. The networks shall utilize only copper and optical fiber communication media as appropriate and shall comply with applicable codes, ordinances and regulations. They may also utilize digital wireless technologies as appropriate to the application and if approved by the VA.
3. All necessary telephone lines, ISDN lines and internet Service Provider services and connections will be provided by the VA.

D. Third Party Interfaces:

1. The contractor administered by this Section of the technical specifications shall include necessary hardware, equipment, software and programming to allow data communications between the controls systems and building systems supplied by other trades.
2. Other manufacturers and contractors supplying other associated systems and equipment shall provide their necessary hardware, software and start-up at their cost and shall cooperate fully with the contractor administered by this Section of the technical specifications in a timely manner and at their cost to ensure complete functional integration.

E. Servers:

1. Provide data storage server(s) to archive historical data including trends, alarm and event histories and transaction logs.
2. Equip these server(s) with the same software tool set that is located in the BACnet building controllers for system configuration and custom logic definition and color graphic configuration.
3. Access to all information on the data storage server(s) shall be through the same browser functionality used to access individual nodes. When logged onto a server the operator will be able to also interact with any other controller on the control system as required for the functional operation of the controls systems. The contractor administered by this Section of the technical specifications shall provide all necessary digital processor programmable data storage server(s).

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4. These server(s) shall be utilized for controls systems application configuration, for archiving, reporting and trending of data, for operator transaction archiving and reporting, for network information management, for alarm annunciation, for operator interface tasks, for controls application management and similar. These server(s) shall utilize IT industry standard data base platforms which utilize a database declarative language designed for managing data in relational database management systems (RDBMS) such as SQL.

**2.3 COMMUNICATION**

- A. Control products, communication media, connectors, repeaters, hubs, and routers shall comprise a BACnet internetwork. Controller and operator interface communication shall conform to ANSI/ASHRAE Standard 135-2008, BACnet.
  1. The Data link / physical layer protocol (for communication) acceptable to the VA throughout its facilities is Ethernet (ISO 8802-3) and BACnet/IP.
  2. The MS/TP data link / physical layer protocol is not acceptable to the VA in any new BACnet network or sub-network in its healthcare or lab facilities.
- B. Each controller shall have a communication port for connection to an operator interface.
- C. Internetwork operator interface and value passing shall be transparent to internetwork architecture.
  1. An operator interface connected to a controller shall allow the operator to interface with each internetwork controller as if directly connected. Controller information such as data, status, reports, system software, and custom programs shall be viewable and editable from each internetwork controller.
  2. Inputs, outputs, and control variables used to integrate control strategies across multiple controllers shall be readable by each controller on the internetwork. Program and test all cross-controller links required to execute specified control system operation. An authorized operator shall be able to edit cross-controller links by typing a standard object address.
- D. System shall be expandable to at least twice the required input and output objects with additional controllers, associated devices, and

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wiring. Expansion shall not require operator interface hardware additions or software revisions.

- E. Controllers with real-time clocks shall use the BACnet Time Synchronization service. The system shall automatically synchronize system clocks daily from an operator-designated device via the internetwork. The system shall automatically adjust for daylight savings and standard time as applicable.

**2.4 ENGINEERING CONTROL CENTER (ECC).**

A. ECC Software:

1. Provide for automatic system database save and restore on the existing ECC's hard disk a copy of the current database of each Controller. This database shall be updated whenever a change is made in any system panel. In the event of a database loss in a building management panel, the ECC shall automatically restore the database for that panel. This capability may be disabled by the operator.
2. Provide for manual database save and restore. An operator with proper clearance shall be able to save the database from any system panel. The operator also shall be able to clear a panel database and manually initiate a download of a specified database to any panel in the system.
3. Provide a method of configuring the system. This shall allow for future system changes or additions by users with proper clearance.
4. Operating System. Furnish a concurrent multi-tasking operating system. The operating system also shall support the use of other common software applications. Acceptable operating systems are Windows XP, Windows System 7, Linux, and UNIX.
5. System Graphics. The operator workstation software shall be graphically oriented. The system shall allow display of up to 10 graphic screens at once for comparison and monitoring of system status. Provide a method for the operator to easily move between graphic displays and change the size and location of graphic displays on the screen. The system graphics shall be able to be modified while on-line. An operator with the proper password level shall be able to add, delete, or change dynamic objects on a graphic. Dynamic objects shall include analog and binary values, dynamic text, static text, and animation files. Graphics shall have

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the ability to show animation by shifting image files based on the status of the object.

6. Custom Graphics. Custom graphic files shall be created with the use of a graphics generation package furnished with the system. The graphics generation package shall be a graphically based system that uses the mouse to create and modify graphics that are saved in industry standard formats such as PCX, TIFF, and GEM. The graphics generation package also shall provide the capability of capturing or converting graphics from other programs such as Designer or AutoCAD.
7. Graphics Library. Furnish a complete library of standard HVAC equipment graphics such as chillers, boilers, air handlers, terminals, fan coils, and unit ventilators. This library also shall include standard symbols for other equipment including fans, pumps, coils, valves, piping, dampers, and ductwork. The library shall be furnished in a file format compatible with the graphics generation package program.
8. The Controls Systems Operator Interfaces shall be user friendly, readily understood and shall make maximum use of colors, graphics, icons, embedded images, animation, text based information and data visualization techniques to enhance and simplify the use and understanding of the displays by authorized users at the ECC. The operating system shall be Windows XP or better, and shall support the third party software.
9. Provide graphical user software, which shall minimize the use of keyboard through the use of the mouse and "point and click" approach to menu selection.
10. The software shall provide a multi-tasking type environment that will allow the user to run several applications simultaneously. The mouse or Alt-Tab keys shall be used to quickly select and switch between multiple applications. The operator shall be able automatically export data to and work in Microsoft Word, Excel, and other Windows based software programs, while concurrently on-line system alarms and monitoring information.
11. On-Line Help. Provide a context-sensitive, on-line help system to assist the operator in operating and editing the system. On-line help shall be available for all applications and shall provide the

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relevant data for that particular screen. Additional help information shall be available through the use of hypertext.

12. User access shall be protected by a flexible and Owner re-definable software-based password access protection. Password protection shall be multi-level and partition able to accommodate the varied access requirements of the different user groups to which individual users may be assigned. Provide the means to define unique access privileges for each individual authorized user. Provide the means to on-line manage password access control under the control of a project specific Master Password. Provide an audit trail of all user activity on the Controls Systems including all actions and changes.
13. The system shall be completely field-programmable from the common operator's keyboard thus allowing hard disk storage of all data automatically. All programs for the CUs shall be able to be downloaded from the hard disk. The software shall provide the following functionality as a minimum:
  - a. Point database editing, storage and downloading of controller databases.
  - b. Scheduling and override of building environmental control systems.
  - c. Collection and analysis of historical data.
  - d. Alarm reporting, routing, messaging, and acknowledgement.
  - e. Definition and construction of dynamic color graphic displays.
  - f. Real-time graphical viewing and control of environment.
  - g. Scheduling trend reports.
  - h. Program editing.
  - i. Operating activity log and system security.
  - j. Transfer data to third party software.
14. Provide functionality such that using the least amount of steps to initiate the desired event may perform any of the following simultaneously:
  - a. Dynamic color graphics and graphic control.
  - b. Alarm management.
  - c. Event scheduling.
  - d. Dynamic trend definition and presentation.
  - e. Program and database editing.

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- f. Each operator shall be required to log on to the system with a user name and password to view, edit or delete the data. System security shall be selectable for each operator, and the password shall be able to restrict the operator's access for viewing and changing the system programs. Each operator shall automatically be logged off the system if no keyboard or mouse activity is detected for a selected time.

15. Graphic Displays:

- a. The workstation shall allow the operator to access various system schematics and floor plans via a graphical penetration scheme, menu selection, or text based commands. Graphic software shall permit the importing of AutoCAD or scanned pictures in the industry standard format (such as PCX, BMP, GIF, and JPEG) for use in the system.
- b. System Graphics shall be project specific and schematically correct for each system. (ie: coils, fans, dampers located per equipment supplied with project.) Standard system graphics that do not match equipment or system configurations are not acceptable. Operator shall have capability to manually operate the entire system from each graphic screen at the ECC. Each system graphic shall include a button/tab to a display of the applicable sequence of operation.
- c. Dynamic temperature values, humidity values, flow rates, and status indication shall be shown in their locations and shall automatically update to represent current conditions without operator intervention and without pre-defined screen refresh values.
- d. Color shall be used to indicate status and change in status of the equipment. The state colors shall be user definable.
- e. A clipart library of HVAC equipment, such as chillers, boilers, air handling units, fans, terminal units, pumps, coils, standard ductwork, piping, valves and laboratory symbols shall be provided in the system. The operator shall have the ability to add custom symbols to the clipart library.
- f. A dynamic display of the site-specific architecture showing status of the controllers, the ECC and network shall be provided.

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- g. The windowing environment of the workstation shall allow the user to simultaneously view several applications at a time to analyze total building operation or to allow the display of graphic associated with an alarm to be viewed without interrupting work in progress. The graphic system software shall also have the capability to split screen, half portion of the screen with graphical representation and the other half with sequence of operation of the same HVAC system.
- 16. Trend reports shall be generated on demand or pre-defined schedule and directed to monitor display, printers or disk. As a minimum, the system shall allow the operator to easily obtain the following types of reports:
  - a. A general list of all selected points in the network.
  - b. List of all points in the alarm.
  - c. List of all points in the override status.
  - d. List of all disabled points.
  - e. List of all points currently locked out.
  - f. List of user accounts and password access levels.
  - g. List of weekly schedules.
  - h. List of holiday programming.
  - i. List of limits and dead bands.
  - j. Custom reports.
  - k. System diagnostic reports, including, list of digital controllers on the network.
  - l. List of programs.
- 17. ASHRAE Standard 147 Report: Provide a daily report that shows the operating condition of each chiller as recommended by ASHRAE Standard 147. At a minimum, this report shall include:
  - a. Chilled water (or other secondary coolant) inlet and outlet temperature
  - b. Chilled water (or other secondary coolant) flow
  - c. Chilled water (or other secondary coolant) inlet and outlet pressures
  - d. Evaporator refrigerant pressure and temperature
  - e. Condenser refrigerant pressure and liquid temperature
  - f. Condenser water inlet and outlet temperatures
  - g. Condenser water flow

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- h. Refrigerant levels
  - i. Oil pressure and temperature
  - j. Oil level
  - k. Compressor refrigerant discharge temperature
  - l. Compressor refrigerant suction temperature
  - m. Addition of refrigerant
  - n. Addition of oil
  - o. Vibration levels or observation that vibration is not excessive
  - p. Motor amperes per phase
  - q. Motor volts per phase
  - r. PPM refrigerant monitor level
  - s. Purge exhaust time or discharge count
  - t. Ambient temperature (dry-bulb and wet-bulb)
  - u. Date and time logged
18. Electrical, Gas, and Weather Reports
- a. Electrical Meter Report: Provide a monthly report showing the daily electrical consumption and peak electrical demand with time and date stamp for each building meter.
  - b. Provide an annual (12-month) summary report showing the monthly electrical consumption and peak demand with time and date stamp for each meter.
  - c. Gas Meter Report: Provide a monthly report showing the daily natural gas consumption for each meter. Provide an annual (12-month) report that shows the monthly consumption for each meter.
  - d. Weather Data Report: Provide a monthly report showing the daily minimum, maximum, and average outdoor air temperature, as well as the number of heating and cooling degree-days for each day. Provide an annual (12-month) report showing the minimum, maximum, and average outdoor air temperature for the month, as well as the number of heating and cooling degree-days for the month.
19. Scheduling and Override:
- a. Provide override access through menu selection from the graphical interface and through a function key.
  - b. Provide a calendar type format for time-of-day scheduling and overrides of building control systems. Schedules reside in the ECC. The digital controllers shall ensure equipment time scheduling when the ECC is off-line. The ECC shall not be



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required to execute time scheduling. Provide the following spreadsheet graphics as a minimum:

- 1) Weekly schedules.
- 2) Zone schedules, minimum of 100 zones.
- 3) Scheduling up to 365 days in advance.
- 4) Scheduled reports to print at workstation.

20. Collection and Analysis of Historical Data:

- a. Provide trending capabilities that will allow the operator to monitor and store records of system activity over an extended period of time. Points may be trended automatically on time based intervals or change of value, both of which shall be user definable. The trend interval could be five (5) minutes to 120 hours. Trend data may be stored on hard disk for future diagnostic and reporting. Additionally trend data may be archived to network drives or removable disk media for off-site retrieval.
- b. Reports may be customized to include individual points or predefined groups of at least six points. Provide additional functionality to allow pre-defined groups of up to 250 trended points to be easily accessible by other industry standard word processing and spreadsheet packages. The reports shall be time and date stamped and shall contain a report title and the name of the facility.
- c. System shall have the set up to generate spreadsheet reports to track energy usage and cost based on weekly or monthly interval, equipment run times, equipment efficiency, and/or building environmental conditions.
- d. Provide additional functionality that will allow the operator to view real time trend data on trend graph displays. A minimum of 20 points may be graphed regardless of whether they have been predefined for trending. In addition, the user may pause the graph and take snapshots of the screens to be stored on the workstation disk for future reference and trend analysis. Exact point values may be viewed and the graph may be printed. Operator shall be able to command points directly on the trend plot by double clicking on the point.

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21. Alarm Management:

- a. Alarm routing shall allow the operator to send alarm notification to selected printers or operator workstation based on time of day, alarm severity, or point type.
- b. Alarm notification shall be provided via two alarm icons, to distinguish between routine, maintenance type alarms and critical alarms. The critical alarms shall display on the screen at the time of its occurrence, while others shall display by clicking on their icon.
- c. Alarm display shall list the alarms with highest priority at the top of the display. The alarm display shall provide selector buttons for display of the associated point graphic and message in English language. The operator shall be able to sort out the alarms.
- d. Alarm messages shall be customized for each point to display detailed instructions to the operator regarding actions to take in the event of an alarm.
- e. An operator with proper security level access may acknowledge and clear the alarm. All that have not been cleared shall be archived at workstation disk.

22. Remote Communications:       The system shall have the ability to dial out in the event of an alarm. Receivers shall include operator workstations, e-mail addresses, and alpha-numeric pagers. The alarm message shall include the name of the calling location, the device that generated the alarm, and the alarm message itself.

23. System Configuration:

- a. Network control strategies shall not be restricted to a single digital controller, but shall be able to include data from all other network devices to allow the development of global control strategies.
- b. Provide automatic backup and restore of all digital controller databases on the workstation hard disk. In addition to all backup data, all databases shall be performed while the workstation is on-line without disturbing other system operations.

**2.5 PORTABLE OPERATOR'S TERMINAL (POT)**

- A. Provide a portable operator's terminal (POT) that shall be capable of accessing all system data. POT may be connected to any point on the

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system network or may be connected directly to any controller for programming, setup, and troubleshooting. POT shall communicate using BACnet protocol. POT may be connected to any point on the system network or it may be connected directly to controllers using the BACnet PTP (Point-To-Point) Data Link/ Physical layer protocol. The terminal shall use the Read (Initiate) and Write (Execute) BACnet Services. POT shall be an IBM-compatible notebook-style PC including all software and hardware required.

- B. Hardware: POT shall conform to the BACnet Advanced Workstation (B-AWS) Profile and shall be BTL-Listed as a B-AWS device.
  - 1. POT shall be commercial standard with supporting 32- or 64-bit hardware (as limited by the direct-digital control system software) and software enterprise server. Internet Explorer v6.0 SP1 or higher, Windows Script Hosting version 5.6 or higher, Windows Message Queuing, Windows Internet Information Services (IIS) v5.0 or higher, minimum 2.8 GHz processor, minimum 500 GB 7200 rpm SATA hard drive with 16 MB cache, minimum 2GB DDR3 SDRAM (minimum 1333 Mhz) memory, 512 MB video card, minimum 16 inch (diagonal) screen, 10-100-1000 Base-TX Ethernet NIC with an RJ45 connector or a 100Base-FX Ethernet NIC with an SC/ST connector, 56,600 bps modem, an ASCII RS-232 interface, and a 16 speed high density DVD-RW+/- optical drive.
- C. Software: POT shall include software equal to the software on the ECC.

**2.6 CONTROLLERS**

- A. General. Provide an adequate number of BTL-Listed B-BC building controllers and an adequate number of BTL-Listed B-AAC advanced application controllers to achieve the performance specified in the Part 1 Article on "System Performance." Each of these controllers shall meet the following requirements.
  - 1. The controller shall have sufficient memory to support its operating system, database, and programming requirements.
  - 2. The building controller shall share data with the ECC and the other networked building controllers. The advanced application controller shall share data with its building controller and the other networked advanced application controllers.
  - 3. The operating system of the controller shall manage the input and output communication signals to allow distributed controllers to

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- share real and virtual object information and allow for central monitoring and alarms.
4. Controllers that perform scheduling shall have a real-time clock.
  5. The controller shall continually check the status of its processor and memory circuits. If an abnormal operation is detected, the controller shall:
    - a. assume a predetermined failure mode, and
    - b. generate an alarm notification.
  6. The controller shall communicate with other BACnet devices on the internetwork using the BACnet Read (Execute and Initiate) and Write (Execute and Initiate) Property services.
  7. Communication.
    - a. Each controller shall reside on a BACnet network using the ISO 8802-3 (Ethernet) Data Link/Physical layer protocol for its communications. Each building controller also shall perform BACnet routing if connected to a network of custom application and application specific controllers.
    - b. The controller shall provide a service communication port using BACnet Data Link/Physical layer protocol for connection to a portable operator's terminal.
  8. Keypad. A local keypad and display shall be provided for each controller. The keypad shall be provided for interrogating and editing data. Provide a system security password shall be available to prevent unauthorized use of the keypad and display.
  9. Serviceability. Provide diagnostic LEDs for power, communication, and processor. All wiring connections shall be made to field-removable, modular terminal strips or to a termination card connected by a ribbon cable.
  10. Memory. The controller shall maintain all BIOS and programming information in the event of a power loss for at least 72 hours.
  11. The controller shall be able to operate at 90% to 110% of nominal voltage rating and shall perform an orderly shutdown below 80% nominal voltage. Controller operation shall be protected against electrical noise of 5 to 120 Hz and from keyed radios up to 5 W at 1 m (3 ft).
- B. Provide BTL-Listed B-ASC application specific controllers for each piece of equipment for which they are constructed. Application

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specific controllers shall communicate with other BACnet devices on the internetwork using the BACnet Read (Execute) Property service.

1. Each B-ASC shall be capable of stand-alone operation and shall continue to provide control functions without being connected to the network.
2. Each B-ASC will contain sufficient I/O capacity to control the target system.
3. Communication.
  - a. Each controller shall reside on a BACnet network using the ISO 8802-3 (Ethernet) Data Link/Physical layer protocol for its communications. Each building controller also shall perform BACnet routing if connected to a network of custom application and application specific controllers.
  - b. Each controller shall reside on an ARCNET network using the ISO 8802-2 Data Link/Physical layer protocol for its communications.
  - c. Each controller shall have a BACnet Data Link/Physical layer compatible connection for a laptop computer or a portable operator's tool. This connection shall be extended to a space temperature sensor port where shown.
4. Serviceability. Provide diagnostic LEDs for power, communication, and processor. All wiring connections shall be made to field-removable, modular terminal strips or to a termination card connected by a ribbon cable.
5. Memory. The application specific controller shall use nonvolatile memory and maintain all BIOS and programming information in the event of a power loss.
6. Immunity to power and noise. Controllers shall be able to operate at 90% to 110% of nominal voltage rating and shall perform an orderly shutdown below 80%. Operation shall be protected against electrical noise of 5-120 Hz and from keyed radios up to 5 W at 1 m (3 ft).
7. Transformer. Power supply for the ASC must be rated at a minimum of 125% of ASC power consumption and shall be of the fused or current limiting type.

**C. Direct Digital Controller Software**

1. The software programs specified in this section shall be commercially available, concurrent, multi-tasking operating system

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and support the use of software application that operates under DOS or Microsoft Windows.

2. All points shall be identified by up to 30-character point name and 16-character point descriptor. The same names shall be used at the ECC.
3. All control functions shall execute within the stand-alone control units via DDC algorithms. The VA shall be able to customize control strategies and sequences of operations defining the appropriate control loop algorithms and choosing the optimum loop parameters.
4. All controllers shall be capable of being programmed to utilize stored default values for assured fail-safe operation of critical processes. Default values shall be invoked upon sensor failure or, if the primary value is normally provided by the central or another CU, or by loss of bus communication. Individual application software packages shall be structured to assume a fail-safe condition upon loss of input sensors. Loss of an input sensor shall result in output of a sensor-failed message at the ECC. Each ACU and RCU shall have capability for local readouts of all functions. The UCUs shall be read remotely.
5. All DDC control loops shall be able to utilize any of the following control modes:
  - a. Two position (on-off, slow-fast) control.
  - b. Proportional control.
  - c. Proportional plus integral (PI) control.
  - d. Proportional plus integral plus derivative (PID) control. All PID programs shall automatically invoke integral wind up prevention routines whenever the controlled unit is off, under manual control of an automation system or time initiated program.
  - e. Automatic tuning of control loops.
6. System Security: Operator access shall be secured using individual password and operator's name. Passwords shall restrict the operator to the level of object, applications, and system functions assigned to him. A minimum of six (6) levels of security for operator access shall be provided.
7. Application Software: The controllers shall provide the following programs as a minimum for the purpose of optimizing energy consumption while maintaining comfortable environment for occupants.

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All application software shall reside and run in the system digital controllers. Editing of the application shall occur at the ECC or via a portable operator's terminal, when it is necessary, to access directly the programmable unit.

- a. Power Demand Limiting (PDL): Power demand limiting program shall monitor the building power consumption and limit the consumption of electricity to prevent peak demand charges. PDL shall continuously track the electricity consumption from a pulse input generated at the kilowatt-hour/demand electric meter. PDL shall sample the meter data to continuously forecast the electric demand likely to be used during successive time intervals. If the forecast demand indicates that electricity usage will likely to exceed a user preset maximum allowable level, then PDL shall automatically shed electrical loads. Once the demand load has met, loads that have been shed shall be restored and returned to normal mode. Control system shall be capable of demand limiting by resetting the HVAC system set points to reduce load while maintaining indoor air quality.
- b. Economizer: An economizer program shall be provided for VAV systems. This program shall control the position of air handler relief, return, and outdoors dampers. If the // outdoor air dry bulb temperature falls // outdoor air dry bulb temperature and humidity fall // below changeover set point the energy control center will modulate the dampers to provide 100 percent outdoor air. The operator shall be able to override the economizer cycle and return to minimum outdoor air operation at any time.
- c. Night Setback/Morning Warm up Control: The system shall provide the ability to automatically adjust set points for this mode of operation.
- d. Optimum Start/Stop (OSS): Optimum start/stop program shall automatically be coordinated with event scheduling. The OSS program shall start HVAC equipment at the latest possible time that will allow the equipment to achieve the desired zone condition by the time of occupancy, and it shall also shut down HVAC equipment at the earliest possible time before the end of the occupancy period and still maintain desired comfort conditions. The OSS program shall consider both outside weather

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conditions and inside zone conditions. The program shall automatically assign longer lead times for weekend and holiday shutdowns. The program shall poll all zones served by the associated AHU and shall select the warmest and coolest zones. These shall be used in the start time calculation. It shall be possible to assign occupancy start times on a per air handler unit basis. The program shall meet the local code requirements for minimum outdoor air while the building is occupied. Modification of assigned occupancy start/stop times shall be possible via the ECC.

- e. Event Scheduling: Provide a comprehensive menu driven program to automatically start and stop designated points or a group of points according to a stored time. This program shall provide the capability to individually command a point or group of points. When points are assigned to one common load group it shall be possible to assign variable time advances/delays between each successive start or stop within that group. Scheduling shall be calendar based and advance schedules may be defined up to one year in advance. Advance schedule shall override the day-to-day schedule. The operator shall be able to define the following information:
  - 1) Time, day.
  - 2) Commands such as on, off, auto.
  - 3) Time delays between successive commands.
  - 4) Manual overriding of each schedule.
  - 5) Allow operator intervention.
- f. Alarm Reporting: The operator shall be able to determine the action to be taken in the event of an alarm. Alarms shall be routed to the ECC based on time and events. An alarm shall be able to start programs, login the event, print and display the messages. The system shall allow the operator to prioritize the alarms to minimize nuisance reporting and to speed operator's response to critical alarms. A minimum of six (6) priority levels of alarms shall be provided for each point.
- g. Remote Communications: The system shall have the ability to dial out in the event of an alarm to the ECC and alpha-numeric pagers. The alarm message shall include the name of the calling location,



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the device that generated the alarm, and the alarm message itself. The operator shall be able to remotely access and operate the system using dial up communications. Remote access shall allow the operator to function the same as local access.

- h. Maintenance Management (PM): The program shall monitor equipment status and generate maintenance messages based upon the operators defined equipment run time, starts, and/or calendar date limits. A preventative maintenance alarm shall be printed indicating maintenance requirements based on pre-defined run time. Each preventive message shall include point description, limit criteria and preventative maintenance instruction assigned to that limit. A minimum of 480-character PM shall be provided for each component of units such as air handling units.

**2.7 SENSORS (AIR, WATER AND STEAM)**

- A. Sensors' measurements shall be read back to the DDC system, and shall be visible by the ECC.
- B. Temperature and Humidity Sensors shall be electronic, vibration and corrosion resistant for wall, immersion, and/or duct mounting. Provide all remote sensors as required for the systems.
  - 1. Temperature Sensors: thermistor type for terminal units and Resistance Temperature Device (RTD) with an integral transmitter type for all other sensors.
    - a. Duct sensors shall be rigid or averaging type as shown on drawings. Averaging sensor shall be a minimum of 1 linear ft of sensing element for each sq ft of cooling coil face area.
    - b. Immersion sensors shall be provided with a separable well made of stainless steel, bronze or monel material. Pressure rating of well is to be consistent with the system pressure in which it is to be installed.
    - c. Space sensors shall be equipped with in-space User set-point adjustment, override switch, numerical temperature display on sensor cover, and communication port. Match room thermostats. Provide a tooled-access cover.
      - 1) Public space sensor: setpoint adjustment shall be only through the ECC or through the DDC system's diagnostic device/laptop. Do not provide in-space User set-point adjustment. Provide an

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- opaque keyed-entry cover if needed to restrict in-space User set-point adjustment.
- 2) Psychiatric patient room sensor: sensor shall be flush with wall, shall not include an override switch, numerical temperature display on sensor cover, shall not include a communication port and shall not allow in-space User set-point adjustment. Setpoint adjustment shall be only through the ECC or through the DDC system's diagnostic device/laptop. Provide a stainless steel cover plate with an insulated back and security screws.
- d. Outdoor air temperature sensors shall have watertight inlet fittings and be shielded from direct sunlight.
- e. Room security sensors shall have stainless steel cover plate with insulated back and security screws.
- f. Wire: Twisted, shielded-pair cable.
- g. Output Signal: 4-20 ma.
- 2. Humidity Sensors: Bulk polymer sensing element type.
  - a. Duct and room sensors shall have a sensing range of 20 to 80 percent with accuracy of  $\pm 2$  to  $\pm 5$  percent RH, including hysteresis, linearity, and repeatability.
  - b. Outdoor humidity sensors shall be furnished with element guard and mounting plate and have a sensing range of 0 to 100 percent RH.
  - c. 4-20 ma continuous output signal.
- C. Static Pressure Sensors: Non-directional, temperature compensated.
  - 1. 4-20 ma output signal.
  - 2. 0 to 5 inches wg for duct static pressure range.
  - 3. 0 to 0.25 inch wg for Building static pressure range.
- D. Water Flow Sensors: shall be insertion turbine type with turbine element, retractor and preamplifier/transmitter mounted on a two-inch full port isolation valve; assembly easily removed or installed as a single unit under line pressure through the isolation valve without interference with process flow; calibrated scale shall allow precise positioning of the flow element to the required insertion depth within plus or minus 1 mm (0.05 inch); wetted parts shall be constructed of stainless steel. Operating power shall be nominal 24 VDC. Local

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instantaneous flow indicator shall be LED type in NEMA 4 enclosure with 3-1/2 digit display, for wall or panel mounting.

1. Performance characteristics:

- a. Ambient conditions: -40°C to 60°C (-40°F to 140°F), 5 to 100% humidity.
- b. Operating conditions: 850 kPa (125 psig), 0°C to 120°C (30°F to 250°F), 0.15 to 12 m per second (0.5 to 40 feet per second) velocity.
- c. Nominal range (turn down ratio): 10 to 1.
- d. Preamplifier mounted on meter shall provide 4-20 ma divided pulse output or switch closure signal for units of volume or mass per a time base. Signal transmission distance shall be a minimum of 1,800 meters (6,000 feet). // Preamplifier for bi-directional flow measurement shall provide a directional contact closure from a relay mounted in the preamplifier //.
- e. Pressure Loss: Maximum 1 percent of the line pressure in line sizes above 100 mm (4 inches).
- f. Ambient temperature effects, less than 0.005 percent calibrated span per °C (°F) temperature change.
- g. RFI effect - flow meter shall not be affected by RFI.
- h. Power supply effect less than 0.02 percent of span for a variation of plus or minus 10 percent power supply.

E. Flow switches:

- 1. Shall be either paddle or differential pressure type.
  - a. Paddle-type switches (liquid service only) shall be UL Listed, SPDT snap-acting, adjustable sensitivity with NEMA 4 enclosure.
  - b. Differential pressure type switches (air or water service) shall be UL listed, SPDT snap acting, NEMA 4 enclosure, with scale range and differential suitable for specified application.

F. Current Switches: Current operated switches shall be self powered, solid state with adjustable trip current as well as status, power, and relay command status LED indication. The switches shall be selected to match the current of the application and output requirements of the DDC systems.

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**2.8 CONTROL CABLES**

A. General:

1. Ground cable shields, drain conductors, and equipment to eliminate shock hazard and to minimize ground loops, common-mode returns, noise pickup, cross talk, and other impairments. Comply with Sections 27 05 26 and 26 05 26.
2. Cable conductors to provide protection against induction in circuits. Crosstalk attenuation within the System shall be in excess of -80 dB throughout the frequency ranges specified.
3. Minimize the radiation of RF noise generated by the System equipment so as not to interfere with any audio, video, data, computer main distribution frame (MDF), telephone customer service unit (CSU), and electronic private branch exchange (EPBX) equipment the System may service.
4. The as-installed drawings shall identify each cable as labeled, used cable, and bad cable pairs.
5. Label system's cables on each end. Test and certify cables in writing to the VA before conducting proof-of-performance testing. Minimum cable test requirements are for impedance compliance, inductance, capacitance, signal level compliance, opens, shorts, cross talk, noise, and distortion, and split pairs on all cables in the frequency ranges used. Make available all cable installation and test records at demonstration to the VA. All changes (used pair, failed pair, etc.) shall be posted in these records as the change occurs.
6. Power wiring shall not be run in conduit with communications trunk wiring or signal or control wiring operating at 100 volts or less.

B. Analogue control cabling shall be not less than No. 18 AWG solid, with thermoplastic insulated conductors as specified in Section 26 05 21.

C. Copper digital communication cable between the ECC and the B-BC and B-AAC controllers shall be 100BASE-TX Ethernet, Category 5e or 6, not less than minimum 24 American Wire Gauge (AWG) solid, Shielded Twisted Pair (STP) or Unshielded Twisted Pair (UTP), with thermoplastic insulated conductors, enclosed in a thermoplastic outer jacket, as specified in Section 27 15 00.

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1. Other types of media commonly used within IEEE Std 802.3 LANs (e.g., 10Base-T and 10Base-2) shall be used only in cases to interconnect with existing media.
- D. Optical digital communication fiber, if used, shall be Multimode or Singlemode fiber, 62.5/125 micron for multimode or 10/125 micron for singlemode micron with SC or ST connectors as specified in TIA-568-C.1. Terminations, patch panels, and other hardware shall be compatible with the specified fiber and shall be as specified in Section 27 15 00. Fiber-optic cable shall be suitable for use with the 100Base-FX or the 100Base-SX standard (as applicable) as defined in IEEE Std 802.3.

**2.9 THERMOSTATS AND HUMIDISTATS**

- A. Room thermostats controlling unitary standalone heating and cooling devices not connected to the DDC system shall have three modes of operation (heating - null or dead band - cooling). Thermostats for patient bedrooms shall have capability of being adjusted to eliminate null or dead band. Wall mounted thermostats shall have polished or brushed aluminum finish, setpoint range and temperature display and external adjustment:
  1. Electronic Thermostats: Solid-state, microprocessor based, programmable to daily, weekend, and holiday schedules.
    - a. Public Space Thermostat: Public space thermostat shall have a thermistor sensor and shall not have a visible means of set point adjustment. Adjustment shall be via the digital controller to which it is connected.
    - b. Patient Room Thermostats: thermistor with in-space User set point adjustment and an on-casing room temperature numerical temperature display.
    - c. Psychiatric Patient Room Sensors: Electronic duct sensor as noted under Article 2.4.
    - d. Battery replacement without program loss.
- B. Strap-on thermostats shall be enclosed in a dirt-and-moisture proof housing with fixed temperature switching point and single pole, double throw switch.
- C. Freezestats shall have a minimum of 300 mm (one linear foot) of sensing element for each 0.093 square meter (one square foot) of coil area. A freezing condition at any increment of 300 mm (one foot) anywhere along

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the sensing element shall be sufficient to operate the thermostatic element. Freezestats shall be manually-reset.

- D. Room Humidistats: Provide fully proportioning humidistat with adjustable throttling range for accuracy of settings and conservation. The humidistat shall have set point scales shown in percent of relative humidity located on the instrument. Systems showing moist/dry or high/low are not acceptable.

**2.10 THERMO-MECHANICAL CONVECTOR CONTROLS**

- A. Furnish and install package assembly including thermostatic steam control valve, operator, remote mount sensor and dial and 6 foot capillary tube.

**2.11 ELECTRIC CONTROLS FOR INDUCTION UNITS**

- A. The induction units shall not be connected to the DDC BAS, but shall be controlled by low voltage electric control devices. The system shall be provided emergency power from the electric panel indicated on the drawings. Furnish and install transformer banks as indicated on the plans to convert 120V power to low voltage suitable for selected devices. Furnish and install low voltage power to each induction unit's control package.
- B. Induction Unit Control Package.
1. Furnish and install low voltage temperature sensor with features similar to DDC temperature sensor specified elsewhere. Provide low voltage 2-way modulating control valves to the induction unit manufacturer for factory assembly of their valve package. All devices in the induction unit control package shall be suitable for future conversion to the new DDC system. Install all required wiring and perform all associated programming to achieve sequence of operation indicated on the drawings.

**2.12 FINAL CONTROL ELEMENTS AND OPERATORS**

- A. Fail Safe Operation: Control valves and dampers shall provide "fail safe" operation in either the normally open or normally closed position as required for freeze, moisture, and smoke or fire protection.
- B. Spring Ranges: Range as required for system sequencing and to provide tight shut-off.
- C. Power Operated Control Dampers (other than VAV Boxes): Factory fabricated, balanced type dampers. All modulating dampers shall be opposed blade type and gasketed. Blades for two-position, duct-mounted

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dampers shall be parallel, airfoil (streamlined) type for minimum noise generation and pressure drop.

1. Leakage: maximum leakage in closed position shall not exceed 7 L/S (15 CFMs) differential pressure for outside air and exhaust dampers and 200 L/S/ square meter (40 CFM/sq. ft.) at 50 mm (2 inches) differential pressure for other dampers.
  2. Frame shall be galvanized steel channel with seals as required to meet leakage criteria.
  3. Blades shall be galvanized steel or aluminum, 200 mm (8 inch) maximum width, with edges sealed as required.
  4. Bearing shall be nylon, bronze sleeve or ball type.
  5. Hardware shall be zinc-plated steel. Connected rods and linkage shall be non-slip. Working parts of joints shall be brass, bronze, nylon or stainless steel.
  6. Maximum air velocity and pressure drop through free area the dampers:
    - a. Smoke damper in air handling unit: 305 meter per minute (1000 fpm).
    - b. Duct mounted damper: 600 meter per minute (2000 fpm).
    - c. Maximum static pressure loss: 50 Pascal (0.20 inches water gage).
- D. Smoke Dampers and Combination Fire/Smoke Dampers: Dampers and operators are specified in Section 23 31 00, HVAC DUCTS AND CASINGS. Control of these dampers is specified under this Section.
- E. Control Valves:
1. Valves shall be rated for a minimum of 150 percent of system operating pressure at the valve location but not less than 900 kPa (125 psig).
  2. Valves 50 mm (2 inches) and smaller shall be bronze body with threaded or flare connections.
  3. Valves 60 mm (2 1/2 inches) and larger shall be bronze or iron body with flanged connections.
  4. Brass or bronze seats except for valves controlling media above 100 degrees C (210 degrees F), which shall have stainless steel seats.
  5. Flow characteristics:
    - a. Three way modulating valves shall be globe pattern. Position versus flow relation shall be linear relation for steam or equal percentage for water flow control.

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- b. Two-way modulating valves shall be globe pattern. Position versus flow relation shall be linear for steam and equal percentage for water flow control.
- c. Two-way 2-position valves shall be ball, gate or butterfly type.
- 6. Maximum pressure drop:
  - a. Two position steam control: 20 percent of inlet gauge pressure.
  - b. Modulating Steam Control: 80 percent of inlet gauge pressure (acoustic velocity limitation).
  - c. Modulating water flow control, greater of 3 meters (10 feet) of water or the pressure drop through the apparatus.
- 7. Two position water valves shall be line size.
- F. Damper and Valve Operators and Relays:
  - 1. Electric operator shall provide full modulating control of dampers and valves. A linkage and pushrod shall be furnished for mounting the actuator on the damper frame internally in the duct or externally in the duct or externally on the duct wall, or shall be furnished with a direct-coupled design. Metal parts shall be aluminum, mill finish galvanized steel, or zinc plated steel or stainless steel. Provide actuator heads which allow for electrical conduit attachment. The motors shall have sufficient closure torque to allow for complete closure of valve or damper under pressure. Provide multiple motors as required to achieve sufficient close-off torque.
    - a. Minimum valve close-off pressure shall be equal to the system pump's dead-head pressure, minimum 50 psig for valves smaller than 4 inches.
  - 2. Electronic damper operators: Metal parts shall be aluminum, mill finish galvanized steel, or zinc plated steel or stainless steel. Provide actuator heads which allow for electrical conduit attachment. The motors shall have sufficient closure torque to allow for complete closure of valve or damper under pressure. Provide multiple motors as required to achieve sufficient close-off torque.
    - a. VAV Box actuator shall be mounted on the damper axle or shall be of the air valve design, and shall provide complete modulating control of the damper. The motor shall have a closure torque of 35-inch pounds minimum with full torque applied at close off to attain minimum leakage.



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3. See drawings for required control operation.

**2.13 AIR FLOW CONTROL**

A. Airflow and static pressure shall be controlled via digital controllers with inputs from airflow control measuring stations and static pressure inputs as specified. Controller outputs shall be analog or pulse width modulating output signals. The controllers shall include the capability to control via simple proportional (P) control, proportional plus integral (PI), proportional plus integral plus derivative (PID), and on-off. The airflow control programs shall be factory-tested programs that are documented in the literature of the control manufacturer.

B. Air Flow Measuring Station -- Electronic Thermal Type:

1. Air Flow Sensor Probe:

a. Each air flow sensor shall contain two individual thermal sensing elements. One element shall determine the velocity of the air stream while the other element shall compensate for changes in temperature. Each thermal flow sensor and its associated control circuit and signal conditioning circuit shall be factory calibrated and be interchangeable to allow replacement of a sensor without recalibration of the entire flow station. The sensor in the array shall be located at the center of equal area segment of the duct and the number of sensors shall be adequate to accommodate the expected velocity profile and variation in flow and temperature. The airflow station shall be of the insertion type in which sensor support structures are inserted from the outside of the ducts to make up the complete electronic velocity array.

b. Thermal flow sensor shall be constructed of hermetically sealed thermistors or nickel chromium or reference grade platinum wire, wound over an epoxy, stainless steel or ceramic mandrel and coated with a material suitable for the conditions to be encountered. Each dual sensor shall be mounted in an extruded aluminum alloy strut.

2. Air Flow Sensor Grid Array:

a. Each sensor grid shall consist of a lattice network of temperature sensors and linear integral controllers (ICs) situated inside an aluminum casing suitable for mounting in a

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duct. Each sensor shall be mounted within a strut facing downstream of the airflow and located so that it is protected on the upstream side. All wiring shall be encased (out of the air stream) to protect against mechanical damage.

- b. The casing shall be made of welded aluminum of sufficient strength to prevent structural bending and bowing. Steel or iron composite shall not be acceptable in the casing material.
  - c. Pressure drop through the flow station shall not exceed 4 Pascal (0.015" W.G.) at 1,000 meter per minute (3,000 FPM).
3. Electronics Panel:
- a. Electronics Panel shall consist of a surface mounted enclosure complete with solid-state microprocessor and software.
  - b. Electronics Panel shall be A/C powered 24 VAC and shall have the capability to transmit signals of 0-5 VDC, 0-10 VCD or 4-20 ma for use in control of the HVAC Systems. The electronic panel shall have the capability to accept user defined scaling parameters for all output signals.
  - c. Electronics Panel shall have the capability to digitally display airflow in CFM and temperature in degrees F. The displays shall be provided as an integral part of the electronics panel. The electronic panel shall have the capability to totalize the output flow in CFM for two or more systems, as required. A single output signal may be provided which will equal the sum of the systems totalized. Output signals shall be provided for temperature and airflow. Provide remote mounted air flow or temperature displays where indicated on the plans.
  - d. Electronics Panel shall have the following:
    - 1) Minimum of 12-bit A/D conversion.
    - 2) Field adjustable digital primary output offset and gain.
    - 3) Airflow analog output scaling of 100 to 10,000 FPM.
    - 4) Temperature analog output scaling from -45°C to 70°C (-50°F to 160°F).
    - 5) Analog output resolution (full scale output) of 0.025%.
  - e. All readings shall be in I.P.units.

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4. Thermal flow sensors and its electronics shall be installed as per manufacturer's instructions. The probe sensor density shall be as follows:

Probe Sensor Density	
Area (sq.ft.)	Qty. Sensors
<=1	2
>1 to <4	4
4 to <8	6
8 to <12	8
12 to <16	12
>=16	16

- a. Complete installation shall not exhibit more than  $\pm 2.0\%$  error in airflow measurement output for variations in the angle of flow of up to 10 percent in any direction from its calibrated orientation. Repeatability of readings shall be within  $\pm 0.25\%$ .
- D. Static Pressure Measuring Station: shall consist of one or more static pressure sensors and transmitters along with relays or auxiliary devices as required for a complete functional system. The span of the transmitter shall not exceed two times the design static pressure at the point of measurement. The output of the transmitter shall be true representation of the input pressure with plus or minus 25 Pascal (0.1 inch) W.G. of the true input pressure:
1. Static pressure sensors shall have the same requirements as Airflow Measuring Devices except that total pressure sensors are optional, and only multiple static pressure sensors positioned on an equal area basis connected to a network of headers are required.
  2. For systems with multiple major trunk supply ducts, furnish a static pressure transmitter for each trunk duct. The transmitter signal representing the lowest static pressure shall be selected and this shall be the input signal to the controller.
  3. The controller shall receive the static pressure transmitter signal and CU shall provide a control output signal to the supply fan capacity control device. The control mode shall be proportional plus integral (PI) (automatic reset) and where required shall also include derivative mode.
  4. In systems with multiple static pressure transmitters, provide a switch located near the fan discharge to prevent excessive pressure

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during abnormal operating conditions. High-limit switches shall be manually-reset.

- E. Constant Volume Control Systems shall consist of an air flow measuring station along with such relays and auxiliary devices as required to produce a complete functional system. The transmitter shall receive its air flow signal and static pressure signal from the flow measuring station and shall have a span not exceeding three times the design flow rate. The CU shall receive the transmitter signal and shall provide an output to the fan volume control device to maintain a constant flow rate. The CU shall provide proportional plus integral (PI) (automatic reset) control mode and where required also inverse derivative mode. Overall system accuracy shall be plus or minus the equivalent of 2 Pascal (0.008 inch) velocity pressure as measured by the flow station.

F. Airflow Synchronization:

1. Systems shall consist of an air flow measuring station for each supply and return duct, the CU and such relays, as required to provide a complete functional system that will maintain a constant flow rate difference between supply and return air to an accuracy of  $\pm 10\%$ . In systems where there is no suitable location for a flow measuring station that will sense total supply or return flow, provide multiple flow stations with a differential pressure transmitter for each station. Signals from the multiple transmitters shall be added through the CU such that the resultant signal is a true representation of total flow.
2. The total flow signals from supply and return air shall be the input signals to the CU. This CU shall track the return air fan capacity in proportion to the supply air flow under all conditions.

**PART 3 - EXECUTION**

**3.1 INSTALLATION**

A. Induction Unit Control Valves:

1. Ship induction unit control valves to induction unit manufacturer for assembly into valve package prior to induction unit shipment from factory.

B. General:

1. Examine project plans for control devices and equipment locations; and report any discrepancies, conflicts, or omissions to Resident Engineer for resolution before proceeding for installation.

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2. Install equipment, piping, wiring /conduit parallel to or at right angles to building lines.
3. Install all equipment and piping in readily accessible locations. Do not run tubing and conduit concealed under insulation or inside ducts.
4. Mount control devices, tubing and conduit located on ducts and apparatus with external insulation on standoff support to avoid interference with insulation.
5. Provide sufficient slack and flexible connections to allow for vibration of piping and equipment.
6. Run tubing and wire connecting devices on or in control cabinets parallel with the sides of the cabinet neatly racked to permit tracing.
7. Install equipment level and plum.

**C. Electrical Wiring Installation:**

1. All wiring cabling shall be installed in conduits. Install conduits and wiring in accordance with Specification Section 26 05 33, RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS. Conduits carrying control wiring and cabling shall be dedicated to the control wiring and cabling: these conduits shall not carry power wiring. Provide plastic end sleeves at all conduit terminations to protect wiring from burrs.
2. Install analog signal and communication cables in conduit and in accordance with Specification Section 26 05 21. Install digital communication cables in conduit and in accordance with Specification Section 27 15 00, Communications Horizontal Cabling.
3. Install conduit and wiring between operator workstation(s), digital controllers, electrical panels, indicating devices, instrumentation, miscellaneous alarm points, thermostats, and relays as shown on the drawings or as required under this section.
4. Install all electrical work required for a fully functional system and not shown on electrical plans or required by electrical specifications. Where low voltage (less than 50 volt) power is required, provide suitable Class B transformers.

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5. Install all system components in accordance with local Building Code and National Electric Code.
    - a. Splices: Splices in shielded and coaxial cables shall consist of terminations and the use of shielded cable couplers. Terminations shall be in accessible locations. Cables shall be harnessed with cable ties.
    - b. Equipment: Fit all equipment contained in cabinets or panels with service loops, each loop being at least 300 mm (12 inches) long. Equipment for fiber optics system shall be rack mounted, as applicable, in ventilated, self-supporting, code gauge steel enclosure. Cables shall be supported for minimum sag.
    - c. Cable Runs: Keep cable runs as short as possible. Allow extra length for connecting to the terminal board. Do not bend flexible coaxial cables in a radius less than ten times the cable outside diameter.
    - d. Use vinyl tape, sleeves, or grommets to protect cables from vibration at points where they pass around sharp corners, through walls, panel cabinets, etc.
  6. Conceal cables, except in mechanical rooms and areas where other conduits and piping are exposed.
  7. Permanently label or code each point of all field terminal strips to show the instrument or item served. Color-coded cable with cable diagrams may be used to accomplish cable identification.
  8. Grounding: ground electrical systems per manufacturer's written requirements for proper and safe operation.
- D. Install Sensors and Controls:
1. Temperature Sensors:
    - a. Install all sensors and instrumentation according to manufacturer's written instructions. Temperature sensor locations shall be readily accessible, permitting quick replacement and servicing of them without special skills and tools.
    - b. Calibrate sensors to accuracy specified, if not factory calibrated.
    - c. Use of sensors shall be limited to its duty, e.g., duct sensor shall not be used in lieu of room sensor.

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- d. Install room sensors permanently supported on wall frame. They shall be mounted at 1.5 meter (5.0 feet) above the finished floor.
  - e. Mount sensors rigidly and adequately for the environment within which the sensor operates. Separate extended-bulb sensors from contact with metal casings and coils using insulated standoffs.
  - f. Sensors used in mixing plenum, and hot and cold decks shall be of the averaging of type. Averaging sensors shall be installed in a serpentine manner horizontally across duct. Each bend shall be supported with a capillary clip.
  - g. All pipe mounted temperature sensors shall be installed in wells.
  - h. All wires attached to sensors shall be air sealed in their conduits or in the wall to stop air transmitted from other areas affecting sensor reading.
  - i. Permanently mark terminal blocks for identification. Protect all circuits to avoid interruption of service due to short-circuiting or other conditions. Line-protect all wiring that comes from external sources to the site from lightning and static electricity.
2. Pressure Sensors:
- a. Install duct static pressure sensor tips facing directly downstream of airflow.
  - b. Install high-pressure side of the differential switch between the pump discharge and the check valve.
  - c. Install snubbers and isolation valves on steam pressure sensing devices.
3. Actuators:
- a. Mount and link damper and valve actuators according to manufacturer's written instructions.
  - b. Check operation of damper/actuator combination to confirm that actuator modulates damper smoothly throughout stroke to both open and closed position.
  - c. Check operation of valve/actuator combination to confirm that actuator modulates valve smoothly in both open and closed position.

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4. Flow Switches:
  - a. Install flow switch according to manufacturer's written instructions.
  - b. Mount flow switch a minimum of 5 pipe diameters up stream and 5 pipe diameters downstream or 600 mm (2 feet) whichever is greater, from fittings and other obstructions.
  - c. Assure correct flow direction and alignment.
  - d. Mount in horizontal piping-flow switch on top of the pipe.
- E. Installation of network:
  1. Ethernet:
    - a. The network shall employ Ethernet LAN architecture, as defined by IEEE 802.3. The Network Interface shall be fully Internet Protocol (IP) compliant allowing connection to currently installed IEEE 802.3, Compliant Ethernet Networks.
    - b. The network shall directly support connectivity to a variety of cabling types. As a minimum provide the following connectivity: 100 Base TX (Category 5e cabling) for the communications between the ECC and the B-BC and the B-AAC controllers.
  2. Third party interfaces: Contractor shall integrate real-time data from building systems by other trades and databases originating from other manufacturers as specified and required to make the system work as one system.
- F. Installation of digital controllers and programming:
  1. Provide a separate digital control panel for each major piece of equipment, such as air handling unit, chiller, pumping unit etc. Points used for control loop reset such as outdoor air, outdoor humidity, or space temperature could be located on any of the remote control units.
  2. Provide sufficient internal memory for the specified control sequences and trend logging. There shall be a minimum of 25 percent of available memory free for future use.
  3. System point names shall be modular in design, permitting easy operator interface without the use of a written point index.
  4. Provide software programming for the applications intended for the systems specified, and adhere to the strategy algorithms provided.
  5. Provide graphics for each piece of equipment and floor plan in the building. This includes each, air handling unit, fan, terminal unit,



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pumping unit etc. These graphics shall show all points dynamically as specified in the point list.

**3.2 SYSTEM VALIDATION AND DEMONSTRATION**

A. As part of final system acceptance, a system demonstration is required (see below). Prior to start of this demonstration, the contractor is to perform a complete validation of all aspects of the controls and instrumentation system.

B. Validation

1. Prepare and submit for approval a validation test plan including test procedures for the performance verification tests. Test Plan shall address all specified functions of the ECC and all specified sequences of operation. Explain in detail actions and expected results used to demonstrate compliance with the requirements of this specification. Explain the method for simulating the necessary conditions of operation used to demonstrate performance of the system. Test plan shall include a test check list to be used by the Installer's agent to check and initial that each test has been successfully completed. Deliver test plan documentation for the performance verification tests to the owner's representative 30 days prior to start of performance verification tests. Provide draft copy of operation and maintenance manual with performance verification test.
2. After approval of the validation test plan, installer shall carry out all tests and procedures therein. Installer shall completely check out, calibrate, and test all connected hardware and software to insure that system performs in accordance with approved specifications and sequences of operation submitted. Installer shall complete and submit Test Check List.

C. Demonstration

1. System operation and calibration to be demonstrated by the installer in the presence of the Architect or VA's representative on random samples of equipment as dictated by the Architect or VA's representative. Should random sampling indicate improper commissioning, the owner reserves the right to subsequently witness complete calibration of the system at no addition cost to the VA.
2. Demonstrate to authorities that all required safeties and life safety functions are fully functional and complete.

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3. Make accessible, personnel to provide necessary adjustments and corrections to systems as directed by balancing agency.
4. The following witnessed demonstrations of field control equipment shall be included:
  - a. Observe HVAC systems in shut down condition. Check dampers and valves for normal position.
  - b. Test application software for its ability to communicate with digital controllers, operator workstation, and uploading and downloading of control programs.
  - c. Demonstrate the software ability to edit the control program off-line.
  - d. Demonstrate reporting of alarm conditions for each alarm and ensure that these alarms are received at the assigned location, including operator workstations.
  - e. Demonstrate ability of software program to function for the intended applications-trend reports, change in status etc.
  - f. Demonstrate via graphed trends to show the sequence of operation is executed in correct manner, and that the HVAC systems operate properly through the complete sequence of operation, e.g., seasonal change, occupied/unoccupied mode, and warm-up condition.
  - g. Demonstrate hardware interlocks and safeties functions, and that the control systems perform the correct sequence of operation after power loss and resumption of power loss.
  - h. Prepare and deliver to the VA graphed trends of all control loops to demonstrate that each control loop is stable and the set points are maintained.
  - i. Demonstrate that each control loop responds to set point adjustment and stabilizes within one (1) minute. Control loop trend data shall be instantaneous and the time between data points shall not be greater than one (1) minute.
5. Witnessed demonstration of ECC functions shall consist of:
  - a. Running each specified report.
  - b. Display and demonstrate each data entry to show site specific customizing capability. Demonstrate parameter changes.
  - c. Step through penetration tree, display all graphics, demonstrate dynamic update, and direct access to graphics.
  - d. Execute digital and analog commands in graphic mode.

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- e. Demonstrate DDC loop precision and stability via trend logs of inputs and outputs (6 loops minimum).
- f. Demonstrate EMS performance via trend logs and command trace.
- g. Demonstrate scan, update, and alarm responsiveness.
- h. Demonstrate spreadsheet/curve plot software, and its integration with database.
- i. Demonstrate on-line user guide, and help function and mail facility.
- j. Demonstrate digital system configuration graphics with interactive upline and downline load, and demonstrate specified diagnostics.
- k. Demonstrate multitasking by showing dynamic curve plot, and graphic construction operating simultaneously via split screen.
- l. Demonstrate class programming with point options of beep duration, beep rate, alarm archiving, and color banding.

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SECTION 23 21 13  
HYDRONIC PIPING

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

- A. Water piping to connect HVAC equipment, including the following:
  - 1. Chilled water, , heating hot water and drain piping.
  - 2. Extension of domestic water make-up piping.
  - 3. Glycol-water piping.

**1.2 RELATED WORK**

- A. Section 01 00 00, GENERAL REQUIREMENTS.
- B. Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, and SAMPLES.
- C. Section 03 30 00, CAST-IN-PLACE CONCRETE.
- D. Section 13 05 41, SEISMIC RESTRAINT REQUIREMENTS FOR NON-STRUCTURAL COMPONENTS: Seismic restraints for piping.
- E. Section 23 05 11, COMMON WORK RESULTS FOR HVAC and STEAM GENERATION: General mechanical requirements and items, which are common to more than one section of Division 23.
- F. Section 23 21 23, HYDRONIC PUMPS: Pumps.
- G. Section 23 07 11, HVAC, PLUMBING, and BOILER PLANT INSULATION: Piping insulation.
- H. Section 23 25 00, HVAC WATER TREATMENT: Water treatment for open and closed systems.
- I. Section 23 82 00, CONVECTION HEATING AND COOLING UNITS: VAV and CV units, fan coil units, induction units and convectors.
- J. Section 23 09 23, DIRECT-DIGITAL CONTROL SYSTEM FOR HVAC: Temperature and pressure sensors and valve operators.

**1.3 QUALITY ASSURANCE**

- A. Section 23 05 11, COMMON WORK RESULTS FOR HVAC and STEAM GENERATION, which includes welding qualifications.
- B. Submit prior to welding of steel piping a certificate of Welder's certification. The certificate shall be current and not more than one year old.

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C. All grooved joint couplings, fittings, valves, and specialties shall be the products of a single manufacturer. Grooving tools shall be the same manufacturer as the grooved components.

1. All castings used for coupling housings, fittings, valve bodies, etc., shall be date stamped for quality assurance and traceability.

**1.4 SUBMITTALS**

A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, and SAMPLES.

B. Manufacturer's Literature and Data:

1. Pipe and equipment supports.
2. Pipe and tubing, with specification, class or type, and schedule.
3. Pipe fittings, including miscellaneous adapters and special fittings.
4. Flanges, gaskets and bolting.
5. Grooved joint couplings and fittings.
6. Valves of all types.
7. Strainers.
8. Flexible connectors for water service.
9. Pipe alignment guides.
10. Expansion joints.
11. Expansion compensators.
12. All specified hydronic system components.
13. Water flow measuring devices.
14. Gages.
15. Thermometers and test wells.
16. Seismic bracing details for piping.

C. Manufacturer's certified data report, Form No. U-1, for ASME pressure vessels:

1. Heat Exchangers (Water to Water)
2. Air separators.
3. Expansion tanks.

D. Submit the welder's qualifications in the form of a current (less than one year old) and formal certificate.

E. Coordination Drawings: Refer to Article, SUBMITTALS of Section 23 05 11, COMMON WORK RESULTS FOR HVAC and STEAM GENERATION.

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F. As-Built Piping Diagrams: Provide drawing as follows for chilled water, condenser water, and heating hot water system and other piping systems and equipment.

1. One wall-mounted stick file with complete set of prints. Mount stick file in the chiller plant or control room along with control diagram stick file.
2. One complete set of reproducible drawings.
3. One complete set of drawings in electronic Autocad and pdf format.

**1.5 APPLICABLE PUBLICATIONS**

A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only. American National Standards Institute, Inc.

B. American Society of Mechanical Engineers/American National Standards Institute, Inc. (ASME/ANSI):

B1.20.1-83(R2006) .....Pipe Threads, General Purpose (Inch)

B16.4-06 .....Gray Iron Threaded FittingsB16.18-01           Cast  
Copper Alloy Solder joint Pressure fittings

B16.23-02 .....Cast Copper Alloy Solder joint Drainage  
fittings

B40.100-05 .....Pressure Gauges and Gauge Attachments

C. American National Standards Institute, Inc./Fluid Controls Institute (ANSI/FCI):

70-2-2006 .....Control Valve Seat Leakage

D. American Society of Mechanical Engineers (ASME):

B16.1-98 .....Cast Iron Pipe Flanges and Flanged Fittings

B16.3-2006 .....Malleable Iron Threaded Fittings: Class 150 and  
300

B16.4-2006 .....Gray Iron Threaded Fittings: (Class 125 and  
250)

B16.5-2003 .....Pipe Flanges and Flanged Fittings: NPS ½  
through NPS 24 Metric/Inch Standard

B16.9-07 .....Factory Made Wrought Butt Welding Fittings

B16.11-05 .....Forged Fittings, Socket Welding and Threaded

B16.18-01 .....Cast Copper Alloy Solder Joint Pressure  
Fittings

B16.22-01 .....Wrought Copper and Bronze Solder Joint Pressure  
Fittings.

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B16.24-06 .....Cast Copper Alloy Pipe Flanges and Flanged  
Fittings

B16.39-06 .....Malleable Iron Threaded Pipe Unions

B16.42-06 .....Ductile Iron Pipe Flanges and Flanged Fittings

B31.1-08 .....Power Piping

**E. American Society for Testing and Materials (ASTM):**

A47/A47M-99 (2004) .....Ferritic Malleable Iron Castings

A53/A53M-07 .....Standard Specification for Pipe, Steel, Black  
and Hot-Dipped, Zinc-Coated, Welded and  
Seamless

A106/A106M-08 .....Standard Specification for Seamless Carbon  
Steel Pipe for High-Temperature Service

A126-04 .....Standard Specification for Gray Iron Castings  
for Valves, Flanges, and Pipe Fittings

A183-03 ..... Standard Specification for Carbon Steel Track  
Bolts and Nuts

A216/A216M-08 ..... Standard Specification for Steel Castings,  
Carbon, Suitable for Fusion Welding, for High  
Temperature Service

A234/A234M-07 ..... Piping Fittings of Wrought Carbon Steel and  
Alloy Steel for Moderate and High Temperature  
Service

A307-07 ..... Standard Specification for Carbon Steel Bolts  
and Studs, 60,000 PSI Tensile Strength

A536-84 (2004) ..... Standard Specification for Ductile Iron Castings

A615/A615M-08 ..... Deformed and Plain Carbon Steel Bars for  
Concrete Reinforcement

A653/A 653M-08 ..... Steel Sheet, Zinc-Coated (Galvanized) or Zinc-  
Iron Alloy Coated (Galvannealed) By the Hot-Dip  
Process

B32-08 ..... Standard Specification for Solder Metal

B62-02 ..... Standard Specification for Composition Bronze or  
Ounce Metal Castings

B88-03 ..... Standard Specification for Seamless Copper Water  
Tube

B209-07 ..... Aluminum and Aluminum Alloy Sheet and Plate



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- C177-04 ..... Standard Test Method for Steady State Heat Flux  
Measurements and Thermal Transmission Properties  
by Means of the Guarded Hot Plate Apparatus
- C478-09 ..... Precast Reinforced Concrete Manhole Sections
- C533-07 ..... Calcium Silicate Block and Pipe Thermal  
Insulation
- C552-07 ..... Cellular Glass Thermal Insulation
- D3350-08 ..... Polyethylene Plastics Pipe and Fittings  
Materials
- C591-08 ..... Unfaced Preformed Rigid Cellular  
Polyisocyanurate Thermal Insulation
- D1784-08 ..... Rigid Poly (Vinyl Chloride) (PVC) Compounds and  
Chlorinated Poly (Vinyl Chloride) (CPVC)  
Compound
- D1785-06 ..... Poly (Vinyl Chloride) (PVC) Plastic Pipe,  
Schedules 40, 80 and 120
- D2241-05 ..... Poly (Vinyl Chloride) (PVC) Pressure Rated Pipe  
(SDR Series)
- F439-06 ..... Standard Specification for Chlorinated Poly  
(Vinyl Chloride) (CPVC) Plastic Pipe Fittings,  
Schedule 80
- F441/F441M-02 ..... Standard Specification for Chlorinated Poly  
(Vinyl Chloride) (CPVC) Plastic Pipe, Schedules  
40 and 80
- F477-08 ..... Elastomeric Seals Gaskets) for Joining Plastic  
Pipe
- F. American Water Works Association (AWWA):
- C110-08 ..... Ductile Iron and Grey Iron Fittings for Water
- C203-02 ..... Coal Tar Protective Coatings and Linings for  
Steel Water Pipe Lines Enamel and Tape Hot  
Applied
- G. American Welding Society (AWS):
- B2.1-02 ..... Standard Welding Procedure Specification
- H. Copper Development Association, Inc. (CDA):
- CDA A4015-06 ..... Copper Tube Handbook

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- I. Expansion Joint Manufacturer's Association, Inc. (EJMA):
  - EMJA-2003 .....Expansion Joint Manufacturer's Association  
Standards, Ninth Edition
- J. Manufacturers Standardization Society (MSS) of the Valve and Fitting Industry, Inc.:
  - SP-67-02a .....Butterfly Valves
  - SP-70-06 .....Gray Iron Gate Valves, Flanged and Threaded  
Ends
  - SP-71-05 .....Gray Iron Swing Check Valves, Flanged and  
Threaded Ends
  - SP-80-08 .....Bronze Gate, Globe, Angle and Check Valves
  - SP-85-02 .....Cast Iron Globe and Angle Valves, Flanged and  
Threaded Ends
  - SP-110-96 .....Ball Valves Threaded, Socket-Welding, Solder  
Joint, Grooved and Flared Ends
  - SP-125-00 .....Gray Iron and Ductile Iron In-line, Spring  
Loaded, Center-Guided Check Valves
- K. National Sanitation Foundation/American National Standards Institute, Inc. (NSF/ANSI):
  - 14-06 .....Plastic Piping System Components and Related  
Materials
  - 61-2008 .....Drinking Water System Components - Health  
Effects
- L. Tubular Exchanger Manufacturers Association: TEMA 9th Edition, 2007

**PART 2 - PRODUCTS**

**2.1 PIPE AND EQUIPMENT SUPPORTS, PIPE SLEEVES, AND WALL AND CEILING PLATES**

- A. Provide in accordance with Section 23 05 11, COMMON WORK RESULTS FOR HVAC and STEAM GENERATION.

**2.2 PIPE AND TUBING**

- A. Chilled Water, Heating Hot Water, and Glycol-Water (other than solar), and Vent Piping:
  - 1. Steel: ASTM A53 Grade B, seamless or ERW, Schedule 40.
  - 2. Copper water tube option: ASTM B88, Type K or L, hard drawn.
- B. Extension of Domestic Water Make-up // and All Solar Hot Water // Piping: ASTM B88, Type K or L, hard drawn copper tubing.

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C. Cooling Coil Condensate Drain Piping:

1. From air handling units: Copper water tube, ASTM B88, Type M, or schedule 40 PVC plastic piping.
2. From fan coil, induction or other terminal units: Copper water tube, ASTM B88, Type L for runouts and Type M for mains.

D. Pipe supports, including insulation shields, for above ground piping:

Section 23 05 11, COMMON WORK RESULTS FOR HVAC and STEAM GENERATION.

**2.3 FITTINGS FOR STEEL PIPE**

A. 50 mm (2 inches) and Smaller: Screwed or welded joints.

1. Butt welding: ASME B16.9 with same wall thickness as connecting piping.
2. Forged steel, socket welding or threaded: ASME B16.11.
3. Screwed: 150 pound malleable iron, ASME B16.3. 125 pound cast iron, ASME B16.4, may be used in lieu of malleable iron. Bushing reduction of a single pipe size, or use of close nipples, is not acceptable.
4. Unions: ASME B16.39.
5. Water hose connection adapter: Brass, pipe thread to 20 mm (3/4 inch) garden hose thread, with hose cap nut.

B. 65 mm (2-1/2 inches) and Larger: Welded or flanged joints. Contractor's option: Grooved mechanical couplings and fittings are optional.

1. Butt welding fittings: ASME B16.9 with same wall thickness as connecting piping. Elbows shall be long radius type, unless otherwise noted.
2. Welding flanges and bolting: ASME B16.5:
  - a. Water service: Weld neck or slip-on, plain face, with 6 mm (1/8 inch) thick full face neoprene gasket suitable for 104 degrees C (220 degrees F).
    - 1) Contractor's option: Convolute, cold formed 150 pound steel flanges, with teflon gaskets, may be used for water service.
  - b. Flange bolting: Carbon steel machine bolts or studs and nuts, ASTM A307, Grade B.

C. Welded Branch and Tap Connections: Forged steel weldolets, or branchlets and threadolets may be used for branch connections up to one pipe size smaller than the main. Forged steel half-couplings, ASME B16.11 may be used for drain, vent and gage connections.

D. Grooved Mechanical Pipe Couplings and Fittings (Contractor's Option):

Grooved Mechanical Pipe Couplings and Fittings may be used, with cut or

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roll grooved pipe, in water service up to 110 degrees C (230 degrees F) in lieu of welded, screwed or flanged connections. All joints must be rigid type.

1. Grooved mechanical couplings: Malleable iron, ASTM A47 or ductile iron, ASTM A536, fabricated in two or more parts, securely held together by two or more track-head, square, or oval-neck bolts, ASTM A449 and A183.
2. Gaskets: Rubber product recommended by the coupling manufacturer for the intended service.
3. Grooved end fittings: Malleable iron, ASTM A47; ductile iron, ASTM A536; or steel, ASTM A53 or A106, designed to accept grooved mechanical couplings. Tap-in type branch connections are acceptable.

**2.4 FITTINGS FOR COPPER TUBING**

**A. Joints:**

1. Solder Joints: Joints shall be made up in accordance with recommended practices of the materials applied. Apply 95/5 tin and antimony on all copper piping.
2. Mechanically formed tee connection in water and drain piping: Form mechanically extracted collars in a continuous operation by drilling pilot hole and drawing out tube surface to form collar, having a height of not less than three times the thickness of tube wall. Adjustable collaring device shall insure proper tolerance and complete uniformity of the joint. Notch and dimple joining branch tube in a single process to provide free flow where the branch tube penetrates the fitting.

**B. Bronze Flanges and Flanged Fittings: ASME B16.24.**

**C. Fittings: ANSI/ASME B16.18 cast copper or ANSI/ASME B16.22 solder wrought copper.**

**2.5 FITTINGS FOR PLASTIC PIPING**

- A. Schedule 40, socket type for solvent welding.
- B. Schedule 40 PVC drain piping: Drainage pattern.
- C. Chemical feed piping for condenser water treatment: Chlorinated polyvinyl chloride (CPVC), Schedule 80, ASTM F439.

**2.6 DIELECTRIC FITTINGS**

- A. Provide where copper tubing and ferrous metal pipe are joined.
- B. 50 mm (2 inches) and Smaller: Threaded dielectric union, ASME B16.39.

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- C. 65 mm (2 1/2 inches) and Larger: Flange union with dielectric gasket and bolt sleeves, ASME B16.42.
- D. Temperature Rating, 99 degrees C (210 degrees F).
- E. Contractor's option: On pipe sizes 2" and smaller, screwed end brass ball valves or dielectric nipples may be used in lieu of dielectric unions.

**2.7 SCREWED JOINTS**

- A. Pipe Thread: ANSI B1.20.
- B. Lubricant or Sealant: Oil and graphite or other compound approved for the intended service.

**2.8 VALVES**

- A. Asbestos packing is not acceptable.
- B. All valves of the same type shall be products of a single manufacturer.
- C. Provide chain operators for valves 150 mm (6 inches) and larger when the centerline is located 2400 mm (8 feet) or more above the floor or operating platform.
- D. Shut-Off Valves
  - 1. Ball Valves (Pipe sizes 2" and smaller): MSS-SP 110, screwed or solder connections, brass or bronze body with chrome-plated ball with full port and Teflon seat at 2760 kPa (400 psig) working pressure rating. Provide stem extension to allow operation without interfering with pipe insulation.
  - 2. Butterfly Valves (Pipe Sizes 2-1/2" and larger): Provide stem extension to allow 50 mm (2 inches) of pipe insulation without interfering with valve operation. MSS-SP 67, flange lug type or grooved end rated 1205 kPa (175 psig) working pressure at 93 degrees C (200 degrees F). Valves shall be ANSI Leakage Class VI and rated for bubble tight shut-off to full valve pressure rating. Valve shall be rated for dead end service and bi-directional flow capability to full rated pressure. Not permitted for direct buried pipe applications.
    - a. Body: Cast iron, ASTM A126, Class B. Malleable iron, ASTM A47 electro-plated, or ductile iron, ASTM A536, Grade 65-45-12 electro-plated.
    - b. Trim: Bronze, aluminum bronze, or 300 series stainless steel disc, bronze bearings, 316 stainless steel shaft and manufacturer's recommended resilient seat. Resilient seat shall

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be field replaceable, and fully line the body to completely isolate the body from the product. A phosphate coated steel shaft or stem is acceptable, if the stem is completely isolated from the product.

c. Actuators: Field interchangeable. Valves for balancing service shall have adjustable memory stop to limit open position.

1) Valves 150 mm (6 inches) and smaller: Lever actuator with minimum of seven locking positions, except where chain wheel is required.

2) 3. Gate Valves (Contractor's Option in lieu of Ball or Butterfly Valves):

a) 50 mm (2 inches) and smaller: MSS-SP 80, Bronze, 1034 kPa (150 psig), wedge disc, rising stem, union bonnet.

b) 65 mm (2 1/2 inches) and larger: Flanged, outside screw and yoke. MSS-SP 70, iron body, bronze mounted, 861 kPa (125 psig) wedge disc.

**E. Globe and Angle Valves**

**1. Globe Valves**

a. 50 mm (2 inches) and smaller: MSS-SP 80, bronze, 1034 kPa (150

lb.) Globe valves shall be union bonnet with metal plug type disc.

b. 65 mm (2 1/2 inches) and larger: 861 kPa (125 psig), flanged, iron body, bronze trim, MSS-SP-85 for globe valves.

**2. Angle Valves:**

a. 50 mm (2 inches) and smaller: MSS-SP 80, bronze, 1034 kPa (150

lb.) Angle valves shall be union bonnet with metal plug type disc.

b. 65 mm (2 1/2 inches) and larger: 861 kPa (125 psig), flanged, iron body, bronze trim, MSS-SP-85 for angle.

**F. Check Valves**

**1. Swing Check Valves:**

a. 50 mm (2 inches) and smaller: MSS-SP 80, bronze, 1034 kPa (150

lb.), 45 degree swing disc.

b. 65 mm (2 1/2 inches) and larger: 861 kPa (125 psig), flanged, iron body, bronze trim, MSS-SP-71 for check valves.

2. Non-Slam or Silent Check Valve: Spring loaded double disc swing check or internally guided flat disc lift type check for bubble

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tight shut-off. Provide where check valves are shown in chilled water and hot water piping. Check valves incorporating a balancing feature may be used.

- a. Body: MSS-SP 125 cast iron, ASTM A126, Class B, or steel, ASTM A216, Class WCB, or ductile iron, ASTM 536, flanged, grooved, or wafer type.
- b. Seat, disc and spring: 18-8 stainless steel, or bronze, ASTM B62. Seats may be elastomer material.

G. Water Flow Balancing Valves: For flow regulation and shut-off. Valves shall be line size rather than reduced to control valve size.

- 1. Globe style valve.
- 2. A dual purpose flow balancing valve and adjustable flow meter, with bronze or cast iron body, calibrated position pointer, valved pressure taps or quick disconnects with integral check valves and preformed polyurethane insulating enclosure.
- 3. Provide a readout kit including flow meter, readout probes, hoses, flow charts or calculator, and carrying case.

H. Automatic Balancing Control Valves: Factory calibrated to maintain constant flow (plus or minus five percent) over system pressure fluctuations of at least 10 times the minimum required for control. Provide standard pressure taps and four sets of capacity charts. Valves shall be line size and be of the following design:

- 1. Brass or ferrous body designed for 2067 kPa (300 psig) service at 121 degrees C (250 degrees F), with corrosion resistant, tamper proof, self-cleaning piston/spring assembly that is easily removable for inspection or replacement.
- 2. Combination assemblies containing ball type shut-off valves, unions, flow regulators, strainers with blowdown valves and pressure temperature ports shall be acceptable.
- 3. Provide a readout kit including flow meter, probes, hoses, flow charts and carrying case.

I. Manual Radiator/Convactor Valves: Brass, packless, with position indicator.

## **2.9 WATER FLOW MEASURING DEVICES**

A. Minimum overall accuracy plus or minus three percent over a range of 70 to 110 percent of design flow. Select devices for not less than 110 percent of design flow rate.

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- B. Venturi Type: Bronze, steel, or cast iron with bronze throat, with valved pressure sensing taps upstream and at the throat.
- C. Wafer Type Circuit Sensor: Cast iron wafer-type flow meter equipped with readout valves to facilitate the connecting of a differential pressure meter. Each readout valve shall be fitted with an integral check valve designed to minimize system fluid loss during the monitoring process.
- D. Self-Averaging Annular Sensor Type: Brass or stainless steel metering tube, shutoff valves and quick-coupling pressure connections. Metering tube shall be rotatable so all sensing ports may be pointed down-stream when unit is not in use.
- E. Insertion Turbine Type Sensor: Section 23 09 23, DIRECT-DIGITAL CONTROL SYSTEM FOR HVAC.
- F. Flow Measuring Device Identification:
  - 1. Metal tag attached by chain to the device.
  - 2. Include meter or equipment number, manufacturer's name, meter model, flow rate factor and design flow rate in l/m (gpm).
- G. Portable Water Flow Indicating Meters:
  - 1. Minimum 150 mm (6 inch) diameter dial, forged brass body, beryllium-copper bellows, designed for 1205 kPa (175 psig) working pressure at 121 degrees C (250 degrees F).
  - 2. Bleed and equalizing valves.
  - 3. Vent and drain hose and two 3000 mm (10 feet) lengths of hose with quick disconnect connections.
  - 4. Factory fabricated carrying case with hose compartment and a bound set of capacity curves showing flow rate versus pressure differential.
  - 5. Provide one portable meter for each range of differential pressure required for the installed flow devices.
- H. Permanently Mounted Water Flow Indicating Meters: Minimum 150 mm (6 inch) diameter, or 450 mm (18 inch) long scale, for 120 percent of design flow rate, direct reading in lps (gpm), with three valve manifold and two shut-off valves.

**2.10 STRAINERS**

- A. Y Type.
  - 1. Screens: Bronze, monel metal or 18-8 stainless steel, free area not less than 2-1/2 times pipe area, with perforations as follows: 1.1



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mm (0.045 inch) diameter perforations for 100 mm (4 inches) and larger: 3.2 mm (0.125 inch) diameter perforations.

B. Suction Diffusers: Specified in Section 23 21 23, HYDRONIC PUMPS.

**2.11 FLEXIBLE CONNECTORS FOR WATER SERVICE**

A. Flanged Spool Connector:

1. Single arch or multiple arch type. Tube and cover shall be constructed of chlorobutyl elastomer with full faced integral flanges to provide a tight seal without gaskets. Connectors shall be internally reinforced with high strength synthetic fibers impregnated with rubber or synthetic compounds as recommended by connector manufacturer, and steel reinforcing rings.
2. Working pressures and temperatures shall be as follows:
  - a. Connector sizes 50 mm to 100 mm (2 inches to 4 inches), 1137 kPa (165psig) at 121 degrees C (250 degrees F).
  - b. Connector sizes 125 mm to 300 mm (5 inches to 12 inches), 965 kPa (140 psig) at 121 degrees C (250 degrees F).
3. Provide ductile iron retaining rings and control units.

B. Mechanical Pipe Couplings:

See other fittings specified under Part 2, PRODUCTS.

**2.12 EXPANSION JOINTS**

- A. Factory built devices, inserted in the pipe lines, designed to absorb axial cyclical pipe movement which results from thermal expansion and contraction. This includes factory-built or field-fabricated guides located along the pipe lines to restrain lateral pipe motion and direct the axial pipe movement into the expansion joints.
- B. Manufacturing Quality Assurance: Conform to Expansion Joints Manufacturers Association Standards.
- C. Bellows - Internally Pressurized Type:
  1. Multiple corrugations of Type 304 or Type A240-321 stainless steel.
  2. Internal stainless steel sleeve entire length of bellows.
  3. External cast iron equalizing rings for services exceeding 340 kPa (50 psig).
  4. Welded ends.
  5. Design shall conform to standards of EJMA and ASME B31.1.
  6. External tie rods designed to withstand pressure thrust force upon anchor failure if one or both anchors for the joint are at change in direction of pipeline.

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7. Integral external cover.
- E. Expansion Compensators:
  1. Corrugated bellows, externally pressurized, stainless steel or bronze.
  2. Internal guides and anti-torque devices.
  3. Threaded ends.
  4. External shroud.
  5. Conform to standards of EJMA.
- F. Expansion Joint (Contractor's Option): 2415 kPa (350 psig) maximum working pressure, steel pipe fitting consisting of telescoping body and slip-pipe sections, PTFE modified polyphenylene sulfide coated slide section, with grooved ends, suitable for axial end movement to 75 mm (3 inch).
- G. Expansion Joint Identification: Provide stamped brass or stainless steel nameplate on each expansion joint listing the manufacturer, the allowable movement, flow direction, design pressure and temperature, date of manufacture, and identifying the expansion joint by the identification number on the contract drawings.
- H. Guides: Provide factory-built guides along the pipe line to permit axial movement only and to restrain lateral and angular movement. Guides must be designed to withstand a minimum of 15 percent of the axial force which will be imposed on the expansion joints and anchors. Field-built guides may be used if detailed on the contract drawings.
- I. Supports: Provide saddle supports and frame or hangers for heat exchanger. Mounting height shall be adjusted to facilitate gravity return of steam condensate. Construct supports from steel, weld joints.

**2.13 HYDRONIC SYSTEM COMPONENTS**

- A. Heat Exchanger (Water to Water): Shell and tube type, U-bend removable tube bundle, heating fluid in shell, heated fluid in tubes, equipped with support cradles.
  1. Maximum tube velocity: 2.3 m/s (7.5 feet per second).
  2. Tube fouling factor: TEMA Standards, but not less than 0.001.
  3. Materials:
    - a. Shell: Steel.
    - b. Tube sheet and tube supports: Steel or brass.
    - c. Tubes: 20 mm (3/4 inch) OD copper.

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- d. Head or bonnet: Cast iron or steel.
- 4. Construction: In accordance with ASME Pressure Vessel Code for 861 kPa (125 psig) working pressure for shell and tubes. Provide manufacturer's certified data report, Form No. U-1.
- C. Optional Heat Transfer Package: In lieu of field erected individual components, the Contractor may provide a factory or shop assembled package of converters, pumps, and other components supported on a welded steel frame. Refer to Section 23 22 13, STEAM and STEAM CONDENSATE HEATING PIPING, for additional requirements
- D. Air Purger: Cast iron or fabricated steel, 861 kPa (125 psig) water working pressure, for in-line installation.
- E. Tangential Air Separator: ASME Pressure Vessel Code construction for 861 kPa (125 psig) working pressure, flanged tangential inlet and outlet connection, internal perforated stainless steel air collector tube designed to direct released air into expansion tank, bottom blowdown connection. Provide Form No. U-1. If scheduled on the drawings, provide a removable stainless steel strainer element having 5 mm (3/16 inch) perforations and free area of not less than five times the cross-sectional area of connecting piping.
- G. Closed Expansion (Compression) Tank: ASME Pressure Vessel Code construction for 861 kPa (125 psig) working pressure, steel, rust-proof coated. Provide gage glass, with protection guard, and angle valves with tapped openings for drain (bottom) and plugged vent (top). Provide Form No. U-1.
  - 1. Vertical floor-mounted expansion tank: Provide gage glass, system or drain connection (bottom) and air charging (top) tappings. Provide gate valve and necessary adapters for charging system. Tank support shall consist of floor mounted base ring with drain access opening or four angle iron legs with base plates.
- H. Pressure Reducing Valve (Water): Diaphragm or bellows operated, spring loaded type, with minimum adjustable range of 28 kPa (4 psig) above and below set point. Bronze, brass or iron body and bronze, brass or stainless steel trim, rated 861 kPa (125 psig) working pressure at 107 degrees C (225 degrees F).
- I. Pressure Relief Valve: Bronze or iron body and bronze or stainless steel trim, with testing lever. Comply with ASME Code for Pressure Vessels, Section 8, and bear ASME stamp.

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- J. Automatic Air Vent Valves (where shown): Cast iron or semi-steel body, 1034 kPa (150 psig) working pressure, stainless steel float, valve, valve seat and mechanism, minimum 15 mm (1/2 inch) water connection and 6 mm (1/4 inch) air outlet. Air outlet shall be piped to the nearest floor drain.

**2.14 WATER FILTERS AND POT CHEMICAL FEEDERS**

See section 23 25 00, HVAC WATER TREATMENT, Article 2.2, CHEMICAL TREATMENT FOR CLOSED LOOP SYSTEMS.

**2.15 GAGES, PRESSURE AND COMPOUND**

- A. ASME B40.100, Accuracy Grade 1A, (pressure, vacuum, or compound for air, oil or water), initial mid-scale accuracy 1 percent of scale (Qualify grade), metal or phenolic case, 115 mm (4-1/2 inches) in diameter, 6 mm (1/4 inch) NPT bottom connection, white dial with black graduations and pointer, clear glass or acrylic plastic window, suitable for board mounting. Provide red "set hand" to indicate normal working pressure.
- B. Provide brass lever handle union cock. Provide brass/bronze pressure snubber for gages in water service.
- C. Range of Gages: Provide range equal to at least 130 percent of normal operating range.
1. For condenser water suction (compound): Minus 100 kPa (30 inches Hg) to plus 700 kPa (100 psig).

**2.16 PRESSURE/TEMPERATURE TEST PROVISIONS**

- A. Pete's Plug: 6 mm (1/4 inch) MPT by 75 mm (3 inches) long, brass body and cap, with retained safety cap, nordel self-closing valve cores, permanently installed in piping where shown, or in lieu of pressure gage test connections shown on the drawings.
- B. Provide one each of the following test items to the Resident Engineer:
1. 6 mm (1/4 inch) FPT by 3 mm (1/8 inch) diameter stainless steel pressure gage adapter probe for extra long test plug. PETE'S 500 XL is an example.
2. 90 mm (3-1/2 inch) diameter, one percent accuracy, compound gage, -- 100 kPa (30 inches) Hg to 700 kPa (100 psig) range.

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3. 0 - 104 degrees C (220 degrees F) pocket thermometer one-half degree accuracy, 25 mm (one inch) dial, 125 mm (5 inch) long stainless steel stem, plastic case.

**2.17 THERMOMETERS**

- A. Mercury or organic liquid filled type, red or blue column, clear plastic window, with 150 mm (6 inch) brass stem, straight, fixed or adjustable angle as required for each in reading.
- B. Case: Chrome plated brass or aluminum with enamel finish.
- C. Scale: Not less than 225 mm (9 inches), range as described below, two degree graduations.
- D. Separable Socket (Well): Brass, extension neck type to clear pipe insulation.
- E. Scale ranges:
  1. Chilled Water and Glycol-Water: 0-38 degrees C (32-100 degrees F).
  2. Hot Water and Glycol-Water: -1 - 116 degrees C (30-240 degrees F).

**2.18 FIRESTOPPING MATERIAL**

Refer to Section 23 05 11, COMMON WORK RESULTS FOR HVAC and STEAM GENERATION.

**PART 3 - EXECUTION**

**3.1 GENERAL**

- A. The drawings show the general arrangement of pipe and equipment but do not show all required fittings and offsets that may be necessary to connect pipes to equipment, fan-coils, coils, radiators, etc., and to coordinate with other trades. Provide all necessary fittings, offsets and pipe runs based on field measurements and at no additional cost to the government. Coordinate with other trades for space available and relative location of HVAC equipment and accessories to be connected on ceiling grid. Pipe location on the drawings shall be altered by contractor where necessary to avoid interferences and clearance difficulties.
- B. Store materials to avoid excessive exposure to weather or foreign materials. Keep inside of piping relatively clean during installation and protect open ends when work is not in progress.
- C. Support piping securely. Refer to PART 3, Section 23 05 11, COMMON WORK RESULTS FOR HVAC and STEAM GENERATION. Install heat exchangers at

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height sufficient to provide gravity flow of condensate to the flash tank and condensate pump.

- D. Install piping generally parallel to walls and column center lines, unless shown otherwise on the drawings. Space piping, including insulation, to provide 25 mm (one inch) minimum clearance between adjacent piping or other surface. Unless shown otherwise, slope drain piping down in the direction of flow not less than 25 mm (one inch) in 12 m (40 feet). Provide eccentric reducers to keep bottom of sloped piping flat.
- E. Locate and orient valves to permit proper operation and access for maintenance of packing, seat and disc. Generally locate valve stems in overhead piping in horizontal position. Provide a union adjacent to one end of all threaded end valves. Control valves usually require reducers to connect to pipe sizes shown on the drawing. Install butterfly valves with the valve open as recommended by the manufacturer to prevent binding of the disc in the seat.
- F. Offset equipment connections to allow valving off for maintenance and repair with minimal removal of piping. Provide flexibility in equipment connections and branch line take-offs with 3-elbow swing joints where noted on the drawings.
- G. Tee water piping runouts or branches into the side of mains or other branches. Avoid bull-head tees, which are two return lines entering opposite ends of a tee and exiting out the common side.
- H. Provide manual or automatic air vent at all piping system high points and drain valves at all low points. Install piping to floor drains from all automatic air vents.
- I. Connect piping to equipment as shown on the drawings. Install components furnished by others such as:
  - 1. Water treatment pot feeders and condenser water treatment systems.
  - 2. Flow elements (orifice unions), control valve bodies, flow switches, pressure taps with valve, and wells for sensors.
- J. Thermometer Wells: In pipes 65 mm (2-1/2 inches) and smaller increase the pipe size to provide free area equal to the upstream pipe area.
- K. Firestopping: Fill openings around uninsulated piping penetrating floors or fire walls, with firestop material. For firestopping insulated piping refer to Section 23 07 11, HVAC, PLUMBING, and BOILER PLANT INSULATION.

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- L. Where copper piping is connected to steel piping, provide dielectric connections.

**3.2 PIPE JOINTS**

- A. Welded: Beveling, spacing and other details shall conform to ASME B31.1 and AWS B2.1. See Welder's qualification requirements under "Quality Assurance" in Section 23 05 11, COMMON WORK RESULTS FOR HVAC and STEAM GENERATION.
- B. Screwed: Threads shall conform to ASME B1.20; joint compound shall be applied to male threads only and joints made up so no more than three threads show. Coat exposed threads on steel pipe with joint compound, or red lead paint for corrosion protection.
- C. Mechanical Joint: Pipe grooving shall be in accordance with joint manufacturer's specifications. Lubricate gasket exterior including lips, pipe ends and housing interiors to prevent pinching the gasket during installation. Lubricant shall be as recommended by coupling manufacturer.
- D. 125 Pound Cast Iron Flange (Plain Face): Mating flange shall have raised face, if any, removed to avoid overstressing the cast iron flange.
- E. Solvent Welded Joints: As recommended by the manufacturer.

**3.3 EXPANSION JOINTS (BELLOWS AND SLIP TYPE)**

- A. Anchors and Guides: Provide type, quantity and spacing as recommended by manufacturer of expansion joint and as shown. A professional engineer shall verify in writing that anchors and guides are properly designed for forces and moments which will be imposed.
- B. Cold Set: Provide setting of joint travel at installation as recommended by the manufacturer for the ambient temperature during the installation.
- C. Preparation for Service: Remove all apparatus provided to restrain joint during shipping or installation. Representative of manufacturer shall visit the site and verify that installation is proper.
- D. Access: Expansion joints must be located in readily accessible space. Locate joints to permit access without removing piping or other devices. Allow clear space to permit replacement of joints and to permit access to devices for inspection of all surfaces and for adding.

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**3.4 SEISMIC BRACING ABOVEGROUND PIPING**

Provide in accordance with Section 13 05 41, SEISMIC RESTRAINT REQUIREMENTS FOR NON-STRUCTURAL COMPONENTS.

**3.5 LEAK TESTING ABOVEGROUND PIPING**

- A. Inspect all joints and connections for leaks and workmanship and make corrections as necessary, to the satisfaction of the Resident Engineer. Tests may be either of those below, or a combination, as approved by the Resident Engineer.
- B. An operating test at design pressure, and for hot systems, design maximum temperature.
- C. A hydrostatic test at 1.5 times design pressure. For water systems the design maximum pressure would usually be the static head, or expansion tank maximum pressure, plus pump head. Factory tested equipment (convertors, exchangers, coils, etc.) need not be field tested. Isolate equipment where necessary to avoid excessive pressure on mechanical seals and safety devices.

**3.6 FLUSHING AND CLEANING PIPING SYSTEMS**

- A. Water Piping: Clean systems as recommended by the suppliers of chemicals specified in Section 23 25 00, HVAC WATER TREATMENT.
  - 1. Initial flushing: Remove loose dirt, mill scale, metal chips, weld beads, rust, and like deleterious substances without damage to any system component. Provide temporary piping or hose to bypass coils, control valves, exchangers and other factory cleaned equipment unless acceptable means of protection are provided and subsequent inspection of hide-out areas takes place. Isolate or protect clean system components, including pumps and pressure vessels, and remove any component which may be damaged. Open all valves, drains, vents and strainers at all system levels. Remove plugs, caps, spool pieces, and components to facilitate early debris discharge from system. Sectionalize system to obtain debris carrying velocity of 1.8 m/S (6 feet per second), if possible. Connect dead-end supply and return headers as necessary. Flush bottoms of risers. Install temporary strainers where necessary to protect down-stream equipment. Supply and remove flushing water and drainage by various type hose, temporary and permanent piping and Contractor's booster pumps. Flush until clean as approved by the Resident Engineer.



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2. Cleaning: Using products supplied in Section 23 25 00, HVAC WATER TREATMENT, circulate systems at normal temperature to remove adherent organic soil, hydrocarbons, flux, pipe mill varnish, pipe joint compounds, iron oxide, and like deleterious substances not removed by flushing, without chemical or mechanical damage to any system component. Removal of tightly adherent mill scale is not required. Keep isolated equipment which is "clean" and where dead-end debris accumulation cannot occur. Sectionalize system if possible, to circulate at velocities not less than 1.8 m/S (6 feet per second). Circulate each section for not less than four hours. Blow-down all strainers, or remove and clean as frequently as necessary. Drain and prepare for final flushing.
3. Final Flushing: Return systems to conditions required by initial flushing after all cleaning solution has been displaced by clean make-up. Flush all dead ends and isolated clean equipment. Gently operate all valves to dislodge any debris in valve body by throttling velocity. Flush for not less than one hour.

**3.7 WATER TREATMENT**

- A. Install water treatment equipment and provide water treatment system piping.
- B. Close and fill system as soon as possible after final flushing to minimize corrosion.
- C. Charge systems with chemicals specified in Section 23 25 00, HVAC WATER TREATMENT.
- D. Utilize this activity, by arrangement with the Resident Engineer, for instructing VA operating personnel.

**3.8 OPERATING AND PERFORMANCE TEST AND INSTRUCTION**

- A. Refer to PART 3, Section 23 05 11, COMMON WORK RESULTS FOR HVAC and STEAM GENERATION.
- B. Adjust red set hand on pressure gages to normal working pressure.

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**SECTION 23 21 23**  
**HYDRONIC PUMPS**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

- A. Hydronic pumps for Heating, Ventilating and Air Conditioning.

**1.2 RELATED WORK**

- A. Section 01 00 00, GENERAL REQUIREMENTS.  
B. Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, and SAMPLES.  
C. Section 13 05 41, SEISMIC RESTRAINT REQUIREMENTS FOR NON-STRUCTURAL COMPONENTS.  
D. Section 23 05 11, COMMON WORK RESULTS FOR HVAC and STEAM GENERATION.  
E. Section 23 05 41, NOISE AND VIBRATION CONTROL FOR HVAC PIPING and EQUIPMENT.  
F. Section 23 21 13, HYDRONIC PIPING.  
G. Section 23 05 12, GENERAL MOTOR REQUIREMENTS FOR HVAC and STEAM GENERATION EQUIPMENT.  
H. Section 26 29 11, LOW-VOLTAGE MOTOR STARTERS.

**1.3 QUALITY ASSURANCE**

- A. Refer to Paragraph, QUALITY ASSURANCE, in Section 23 05 11, COMMON WORK RESULTS FOR HVAC and STEAM GENERATION.  
B. Design Criteria:  
1. Pumps design and manufacturer shall conform to Hydraulic Institute Standards.  
2. Pump sizes, capacities, pressures, operating characteristics and efficiency shall be as scheduled.  
3. Head-capacity curves shall slope up to maximum head at shut-off. Curves shall be relatively flat for closed systems. Select pumps near the midrange of the curve, so the design capacity falls to the left of the best efficiency point, to allow a cushion for the usual drift to the right in operation, without approaching the pump curve end point and possible cavitation and unstable operation. Select pumps for open systems so that required net positive suction head (NPSHR) does not exceed the net positive head available (NPSHA).  
4. Pump Driver: Furnish with pump. Size shall be non-overloading at any point on the head-capacity curve, including in a parallel or series pumping installation with one pump in operation.  
5. Provide all pumps with motors, impellers, drive assemblies, bearings, coupling guard and other accessories specified. Statically and dynamically balance all rotating parts.

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6. Furnish each pump and motor with a nameplate giving the manufacturers name, serial number of pump, capacity in GPM and head in feet at design condition, horsepower, voltage, frequency, speed and full load current and motor efficiency.
7. Test all pumps before shipment. The manufacturer shall certify all pump ratings.
8. After completion of balancing, provide replacement of impellers or trim impellers to provide specified flow at actual pumping head, as installed.

C. Allowable Vibration Tolerance for Pump Units: Section 23 05 41, NOISE AND VIBRATION CONTROL FOR HVAC PIPING and EQUIPMENT.

**1.4 SUBMITTALS**

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, and SAMPLES.
- B. Manufacturer's Literature and Data:
  1. Pumps and accessories.
  2. Motors and drives.
  3. Variable speed motor controllers.
- C. Manufacturer's installation, maintenance and operating instructions, in accordance with Section 23 05 11, COMMON WORK RESULTS FOR HVAC and STEAM GENERATION.
- D. Characteristic Curves: Head-capacity, efficiency-capacity, brake horsepower-capacity, and NPSHR-capacity for each pump and for combined pumps in parallel or series service. Identify pump and show fluid pumped, specific gravity, pump speed and curves plotted from zero flow to maximum for the impeller being furnished and at least the maximum diameter impeller that can be used with the casing.

**1.5 APPLICABLE PUBLICATIONS**

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only:
- B. American Iron and Steel Institute (AISI):

AISI 1045 .....Cold Drawn Carbon Steel Bar, Type 1045  
AISI 416 .....Type 416 Stainless Steel
- C. American National Standards Institute (ANSI):

ANSI B15.1-00(R2008)..... Safety Standard for Mechanical Power  
Transmission Apparatus  
ANSI B16.1-05 .....Cast Iron Pipe Flanges and Flanged Fittings,  
Class 25, 125, 250 and 800
- D. American Society for Testing and Materials (ASTM):

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A48-03 (2008) .....Standard Specification for Gray Iron Castings  
B62-2009 .....Standard Specification for Composition Bronze or  
Ounce Metal Castings

E. Maintenance and Operating Manuals in accordance with Section 01 00 00,  
General Requirements.

**1.6 DEFINITIONS**

- A. Capacity: Liters per second (L/s) (Gallons per minute (GPM) of the fluid pumped.
- B. Head: Total dynamic head in kPa (feet) of the fluid pumped.
- C. Flat head-capacity curve: Where the shutoff head is less than 1.16 times the head at the best efficiency point.

**1.7 SPARE MATERIALS**

- A. Furnish one spare seal and casing gasket for each pump to the Resident Engineer.

**PART 2 - PRODUCTS**

**2.1 CENTRIFUGAL PUMPS, BRONZE FITTED**

- A. General:
  - 1. Provide pumps that will operate continuously without overheating bearings or motors at every condition of operation on the pump curve, or produce noise audible outside the room or space in which installed.
  - 2. Provide pumps of size, type and capacity as indicated, complete with electric motor and drive assembly, unless otherwise indicated. Design pump casings for the indicated working pressure and factory test at 1½ times the designed pressure.
  - 3. Provide pumps of the same type, the product of a single manufacturer, with pump parts of the same size and type interchangeable.
  - 4. General Construction Requirements
    - a. Balance: Rotating parts, statically and dynamically.
    - b. Construction: To permit servicing without breaking piping or motor connections.
    - c. Pump Motors: Provide high efficiency motors, inverter duty for variable speed service. Refer to Section 23 05 12, GENERAL MOTOR REQUIREMENTS FOR HVAC and STEAM GENERATION EQUIPMENT. Motors shall be Open Drip Proof and operate at 1750 rpm unless noted otherwise.
    - d. Heating pumps shall be suitable for handling water to 225°F.
    - e. Provide coupling guards that meet ANSI B15.1, Section 8 and OSHA requirements.
    - f. Pump Connections: Flanged.
    - g. Pump shall be factory tested.

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- h. Performance: As scheduled on the Contract Drawings.
- 5. Variable Speed Pumps:
  - a. The pumps shall be the type shown on the drawings and specified herein flex coupled to an open drip-proof motor.
  - b. Variable Speed Motor Controllers: Refer to Section 26 29 11, LOW-VOLTAGE MOTOR STARTERS and to Section 23 05 11, COMMON WORK RESULTS FOR HVAC and STEAM GENERATION paragraph, Variable Speed Motor Controllers. Furnish controllers with pumps and motors.
  - c. Pump operation and speed control shall be as shown on the drawings.
- B. In-Line Type:
  - 1. Casing and Bearing Housing: Close-grained cast iron, ASTM A48.
  - 2. Casing Wear Rings: Bronze.
  - 3. Suction and Discharge: Plain face flange, 850 kPa (125 psig), ANSI B16.1.
  - 4. Casing Vent: Manual brass cock at high point.
  - 5. Casing Drain and Gage Taps: 15 mm (1/2-inch) plugged connections minimum size.
  - 6. Impeller: Bronze, ASTM B62, enclosed type, keyed to shaft.
  - 7. Shaft: Steel, AISI Type 1045 or stainless steel.
  - 8. Shaft Seal: Manufacturer's standard mechanical type to suit pressure and temperature and fluid pumped.
  - 9. Shaft Sleeve: Bronze or stainless steel.
  - 10. Motor: Furnish with pump. Refer to Section 23 05 12, GENERAL MOTOR REQUIREMENTS FOR HVAC AND STEAM GENERATION EQUIPMENT.
  - 11. Provide line sized shut-off valve and suction strainer, maintain manufacturer recommended straight pipe length on pump suction (with blow down valve). Contractor option: Provide suction diffuser as follows:
    - a. Body: Cast iron with steel inlet vanes and combination diffuser-strainer-orifice cylinder with 5 mm (3/16-inch) diameter openings for pump protection. Provide taps for strainer blowdown and gage connections.
    - b. Provide adjustable foot support for suction piping.
    - c. Strainer free area: Not less than five times the suction piping.
    - d. Provide disposable start-up strainer.

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**PART 3 - EXECUTION**

**3.1 INSTALLATION**

- A. Follow manufacturer's written instructions for pump mounting and start-up. Access/Service space around pumps shall not be less than minimum space recommended by pumps manufacturer.
- B. Provide drains for bases and seals for base mounted pumps, piped to and discharging into floor drains.
- C. Coordinate location of thermometer and pressure gauges as per Section 23 21 13, HYDRONIC PIPING.

**3.2 START-UP**

- A. Verify that the piping system has been flushed, cleaned and filled.
- B. Lubricate pumps before start-up.
- C. Prime the pump, vent all air from the casing and verify that the rotation is correct. To avoid damage to mechanical seals, never start or run the pump in dry condition.
- D. Verify that correct size heaters-motor over-load devices are installed for each pump controller unit.
- E. Field modifications to the bearings and or impeller (including trimming) are not permitted. If the pump does not meet the specified vibration tolerance send the pump back to the manufacturer for a replacement pump. All modifications to the pump shall be performed at the factory.
- F. Ensure the disposable strainer is free of debris prior to testing and balancing of the hydronic system.
- G. After several days of operation, replace the disposable start-up strainer with a regular strainer in the suction diffuser.

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SECTION 23 22 13  
STEAM AND CONDENSATE HEATING PIPING

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

- A. Steam, condensate and vent piping inside buildings.

**1.2 RELATED WORK**

- A. Seismic restraints for piping: Section 13 05 41, SEISMIC RESTRAINT REQUIREMENTS FOR NON-STRUCTURAL COMPONENTS.
- B. General mechanical requirements and items, which are common to more than one section of Division 23: Section 23 05 11, COMMON WORK RESULTS FOR HVAC AND STEAM GENERATION.
- C. Piping insulation: Section 23 07 11, HVAC, PLUMBING, AND BOILER PLANT INSULATION.
- D. Water treatment for open and closed systems: Section 23 25 00, HVAC WATER TREATMENT.
- E. Heating Coils and Humidifiers: Section 23 73 00, INDOOR CENTRAL-STATION AIR-HANDLING UNITS and SECTION 23 31 00, HVAC DUCTS AND CASING.
- F. Temperature and pressure sensors and valve operators: Section 23 09 23, DIRECT-DIGITAL CONTROL SYSTEM FOR HVAC.

**1.3 QUALITY ASSURANCE**

- A. Section 23 05 11, COMMON WORK RESULTS FOR HVAC AND STEAM GENERATION, which includes welding qualifications.

**1.4 SUBMITTALS**

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, and SAMPLES.
- B. Manufacturer's Literature and Data:
  - 1. Pipe and equipment supports.
  - 2. Pipe and tubing, with specification, class or type, and schedule.
  - 3. Pipe fittings, including miscellaneous adapters and special fittings.
  - 4. Flanges, gaskets and bolting.
  - 5. Valves of all types.
  - 6. Strainers.
  - 7. Pipe alignment guides.
  - 8. Expansion joints.
  - 9. Expansion compensators.
  - 10. All specified steam system components.
  - 11. Gages.
  - 12. Thermometers and test wells.
  - 13. Seismic bracing details for piping.

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- C. Manufacturer's certified data report, Form No. U-1, for ASME pressure vessels:
  - 1. Heat Exchangers (Steam-to-Hot Water).
  - 2. Flash tanks.
- D. Coordination Drawings: Refer to Article, SUBMITTALS of Section 23 05 11, COMMON WORK RESULTS FOR HVAC AND STEAM GENERATION.
- E. As-Built Piping Diagrams: Provide drawing as follows for steam and steam condensate piping and other central plant equipment.
  - 1. One wall-mounted stick file for prints. Mount stick file in the chiller plant or adjacent control room along with control diagram stick file.
  - 2. One set of reproducible drawings.

**1.5 APPLICABLE PUBLICATIONS**

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.
- B. American Society of Mechanical Engineers/American National Standards Institute (ASME/ANSI):
  - B1.20.1-83(R2006) .....Pipe Threads, General Purpose (Inch)
  - B16.4-2006 .....Gray Iron Threaded Fittings
- C. American Society of Mechanical Engineers (ASME):
  - B16.1-2005 .....Gray Iron Pipe Flanges and Flanged Fittings
  - B16.3-2006 .....Malleable Iron Threaded Fittings
  - B16.9-2007 .....Factory-Made Wrought Buttwelding Fittings
  - B16.11-2005 .....Forged Fittings, Socket-Welding and Threaded
  - B16.14-91 .....Ferrous Pipe Plugs, Bushings, and Locknuts with  
Pipe Threads
  - B16.22-2001 .....Wrought Copper and Copper Alloy Solder-Joint  
Pressure Fittings
  - B16.23-2002 .....Cast Copper Alloy Solder Joint Drainage Fittings
  - B16.24-2006 .....Cast Copper Alloy Pipe Flanges and Flanged  
Fittings, Class 150, 300, 400, 600, 900, 1500  
and 2500
  - B16.39-98 .....Malleable Iron Threaded Pipe Unions, Classes  
150, 250, and 300
  - B31.1-2007 .....Power Piping
  - B31.9-2008 .....Building Services Piping
  - B40.100-2005 .....Pressure Gauges and Gauge Attachments
  - Boiler and Pressure Vessel Code: SEC VIII D1-2001, Pressure Vessels,  
Division 1

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D. American Society for Testing and Materials (ASTM):

A47-99 .....Ferritic Malleable Iron Castings  
A53-2007 .....Pipe, Steel, Black and Hot-Dipped, Zinc-Coated,  
Welded and Seamless  
A106-2008 .....Seamless Carbon Steel Pipe for High-Temperature  
Service  
A126-2004 .....Standard Specification for Gray Iron Castings  
for Valves, Flanges, and Pipe Fittings  
A181-2006 .....Carbon Steel Forgings, for General-Purpose  
Piping  
A183-2003 ..... Carbon Steel Track Bolts and Nuts  
A216-2008 ..... Standard Specification for Steel Castings,  
Carbon, Suitable for Fusion Welding, for High  
Temperature Service  
A285-01 ..... Pressure Vessel Plates, Carbon Steel, Low-and-  
Intermediate-Tensile Strength  
A307-2007 ..... Carbon Steel Bolts and Studs, 60,000 PSI Tensile  
Strength  
A516-2006 ..... Pressure Vessel Plates, Carbon Steel, for  
Moderate-and- Lower Temperature Service  
A536-84(2004)e1 ..... Standard Specification for Ductile Iron Castings  
B32-2008 ..... Solder Metal  
B61-2008 ..... Steam or Valve Bronze Castings  
B62-2009 ..... Composition Bronze or Ounce Metal Castings  
B88-2003 ..... Seamless Copper Water Tube  
F439-06 ..... Socket-Type Chlorinated Poly (Vinyl Chloride)  
(CPVC) Plastic Pipe Fittings, Schedule 80  
F441-02(2008) ..... Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic  
Pipe, Schedules 40 and 80

E. American Welding Society (AWS):

A5.8-2004 .....Filler Metals for Brazing and Braze Welding  
B2.1-00 .....Welding Procedure and Performance Qualifications

F. Manufacturers Standardization Society (MSS) of the Valve and Fitting  
Industry, Inc.:

SP-67-95 .....Butterfly Valves  
SP-70-98 .....Cast Iron Gate Valves, Flanged and Threaded Ends  
SP-71-97 .....Gray Iron Swing Check Valves, Flanged and  
Threaded Ends  
SP-72-99 .....Ball Valves with Flanged or Butt-Welding Ends  
for General Service

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SP-78-98 .....Cast Iron Plug Valves, Flanged and Threaded Ends  
SP-80-97 .....Bronze Gate, Globe, Angle and Check Valves  
SP-85-94 .....Cast Iron Globe and Angle Valves, Flanged and  
Threaded Ends

**G. Military Specifications (Mil. Spec.):**

MIL-S-901D-1989 .....Shock Tests, H.I. (High Impact) Shipboard  
Machinery, Equipment, and Systems

**H. National Board of Boiler and Pressure Vessel Inspectors (NB): Relieving  
Capacities of Safety Valves and Relief Valves**

**I. Tubular Exchanger Manufacturers Association: TEMA 18th Edition, 2000**

**PART 2 - PRODUCTS**

**2.1 PIPE AND EQUIPMENT SUPPORTS, PIPE SLEEVES, AND WALL AND CEILING PLATES**

A. Provide in accordance with Section 23 05 11, COMMON WORK RESULTS FOR  
HVAC AND STEAM GENERATION.

**2.2 PIPE AND TUBING**

- A. Steam Piping: Steel, ASTM A53, Grade B, seamless or ERW; A106 Grade B, Seamless; Schedule 40.
- B. Steam Condensate and Pumped Condensate Piping:
  - 1. Steel, ASTM A53, Grade B, Seamless or ERW, or A106 Grade B Seamless, Schedule 80.
- C. Vent Piping: Steel, ASTM A53, Grade B, seamless or ERW; A106 Grade B, Seamless; Schedule 40, galvanized.

**2.3 FITTINGS FOR STEEL PIPE**

- A. 50 mm (2 inches) and Smaller: Screwed or welded.
  - 1. Butt welding: ASME B16.9 with same wall thickness as connecting piping.
  - 2. Forged steel, socket welding or threaded: ASME B16.11.
  - 3. Screwed: 150 pound malleable iron, ASME B16.3. 125 pound cast iron, ASME B16.4, may be used in lieu of malleable iron, except for steam and steam condensate piping. Provide 300 pound malleable iron, ASME B16.3 for steam and steam condensate piping. Cast iron fittings or piping is not acceptable for steam and steam condensate piping. Bushing reduction of a single pipe size, or use of close nipples, is not acceptable.
  - 4. Unions: ASME B16.39.
  - 5. Steam line drip station and strainer quick-couple blowdown hose connection: Straight through, plug and socket, screw or cam locking type for 15 mm (1/2 inch) ID hose. No integral shut-off is required.
- B. 65 mm (2-1/2 inches) and Larger: Welded or flanged joints.

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1. Butt welding fittings: ASME B16.9 with same wall thickness as connecting piping. Elbows shall be long radius type, unless otherwise noted.
2. Welding flanges and bolting: ASME B16.5:
  - a. Steam service: Weld neck or slip-on, raised face, with non-asbestos gasket. Non-asbestos gasket shall either be stainless steel spiral wound strip with flexible graphite filler or compressed inorganic fiber with nitrile binder rated for saturated and superheated steam service 750 degrees F and 1500 psi.
  - b. Flange bolting: Carbon steel machine bolts or studs and nuts, ASTM A307, Grade B.
- C. Welded Branch and Tap Connections: Forged steel weldolets, or branchlets and threadolets may be used for branch connections up to one pipe size smaller than the main. Forged steel half-couplings, ASME B16.11 may be used for drain, vent and gage connections.

**2.4 SCREWED JOINTS**

- A. Pipe Thread: ANSI B1.20.
- B. Lubricant or Sealant: Oil and graphite or other compound approved for the intended service.

**2.5 VALVES**

- A. Asbestos packing is not acceptable.
- B. All valves of the same type shall be products of a single manufacturer.
- C. Provide chain operators for valves 150 mm (6 inches) and larger when the centerline is located 2100 mm (7 feet) or more above the floor or operating platform.
- D. Shut-Off Valves
  1. Gate Valves:
    - a. 50 mm (2 inches) and smaller: MSS-SP80, Bronze, 1034 kPa (150 lb.), wedge disc, rising stem, union bonnet.
    - b. 65 mm (2 1/2 inches) and larger: Flanged, outside screw and yoke.
      - 1) High pressure steam 413 kPa (60 psig) and above nominal MPS system): Cast steel body, ASTM A216 grade WCB, 1034 kPa (150 psig) at 260 degrees C (500 degrees F), 11-1/2 to 13 percent chrome stainless steel solid disc and seats. Provide 25 mm (1 inch) factory installed bypass with globe valve on valves 100 mm (4 inches) and larger.
      - 2) All other services: MSS-SP 70, iron body, bronze mounted, 861 kPa (125 psig) wedge disc.
- E. Globe and Angle Valves:
  1. Globe Valves:

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- a. 50 mm (2 inches) and smaller: MSS-SP 80, bronze, 1034 kPa (150 lb.) Globe valves shall be union bonnet with metal plug type disc.
  - b. 65 mm (2 1/2 inches) and larger:
    - 1) Globe valves for high pressure steam 413 kPa (60 psig) and above nominal MPS system): Cast steel body, ASTM A216 grade WCB, flanged, OS&Y, 1034 kPa (150 psig) at 260 degrees C (500 degrees F), 11-1/2 to 13 percent chrome stainless steel disc and renewable seat rings.
    - 2) All other services: 861 kPa (125 psig), flanged, iron body, bronze trim, MSS-SP-85 for globe valves.
2. Angle Valves
- a. 50 mm (2 inches) and smaller: MSS-SP 80, bronze, 1034 kPa (150 lb.) Angle valves shall be union bonnet with metal plug type disc.
  - b. 65 mm (2 1/2 inches) and larger:
    - 1) Angle valves for high pressure steam 413 kPa (60 psig) and above nominal MPS system): Cast steel body, ASTM A216 grade WCB, flanged, OS&Y, 1034 kPa (150 psig) at 260 degrees C (500 degrees F), 11-1/2 to 13 percent chrome stainless steel disc and renewable seat rings.
    - 2) All other services: 861 kPa (125 psig), flanged, iron body, bronze trim, MSS-SP-85 for angle valves.
- F. Swing Check Valves
- 1. 50 mm (2 inches) and smaller: MSS-SP 80, bronze, 1034 kPa (150 psig), 45 degree swing disc.
  - 2. 65 mm (2-1/2 inches) and Larger:
    - a Check valves for high pressure steam 413 kPa (60 psig) and above nominal MPS system: Cast steel body, ASTM A216 grade WCB, flanged, OS&Y, 1034 kPa (150 psig) at 260 degrees C (500 degrees F), 11-1/2 to 13 percent chrome stainless steel disc and renewable seat rings.
    - b. All other services: 861 kPa (125 psig), flanged, iron body, bronze trim, MSS-SP-71 for check valves.
- G. Manual Radiator/Convactor Valves: Brass, packless, with position indicator.

**2.6 STRAINERS**

- A. Basket or Y Type. Tee type is acceptable for gravity flow and pumped steam condensate service.
- B. High Pressure Steam: Rated 1034 kPa (150 psig) saturated steam.
  - 1. 50 mm (2 inches) and smaller: Iron, ASTM A116 Grade B, or bronze, ASTM B-62 body with screwed connections (250 psig).

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2. 65 mm (2-1/2 inches) and larger: Flanged cast steel or 1723 kPa (250 psig) cast iron.
- C. All Other Services: Rated 861 kPa (125 psig) saturated steam.
  1. 50 mm (2 inches) and smaller: Cast iron or bronze.
  2. 65 mm (2-1/2 inches) and larger: Flanged, iron body.
- D. Screens: Bronze, monel metal or 18-8 stainless steel, free area not less than 2-1/2 times pipe area, with perforations as follows:
  1. 75 mm (3 inches) and smaller: 20 mesh for steam and 1.1 mm (0.045 inch) diameter perforations for liquids.
  2. 100 mm (4 inches) and larger: 1.1 mm (0.045) inch diameter perforations for steam and 3.2 mm (0.125 inch) diameter perforations for liquids.

**2.7 PIPE ALIGNMENT**

- A. Guides: Provide factory-built guides along the pipe line to permit axial movement only and to restrain lateral and angular movement. Guides must be designed to withstand a minimum of 15 percent of the axial force which will be imposed on the expansion joints and anchors. Field-built guides may be used if detailed on the contract drawings.

**2.8 EXPANSION JOINTS**

- A. Factory built devices, inserted in the pipe lines, designed to absorb axial cyclical pipe movement which results from thermal expansion and contraction. This includes factory-built or field-fabricated guides located along the pipe lines to restrain lateral pipe motion and direct the axial pipe movement into the expansion joints.
- B. Minimum Service Requirements:
  1. Pressure Containment:
    - a. Steam Service 35-200 kPa (5-30 psig): Rated 345 kPa (50 psig) at 148 degrees C (298 degrees F).
    - b. Steam Service 214-850 kPa (31-125 psig): Rated 1025 kPa (150 psig) at 186 degrees C (366 degrees F).
    - c. Condensate Service: Rated 690 kPa (100 psig) at 154 degrees C (310 degrees F).
  2. Number of Full Reverse Cycles without failure: Minimum 1000.
  3. Movement: As shown on drawings plus recommended safety factor of manufacturer.
- C. Manufacturing Quality Assurance: Conform to Expansion Joints Manufacturers Association Standards.
- D. Bellows - Internally Pressurized Type:
  1. Multiple corrugations of Type 304 or Type A240-321 stainless steel.
  2. Internal stainless steel sleeve entire length of bellows.

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3. External cast iron equalizing rings for services exceeding 340 kPa (50 psig).
  4. Welded ends.
  5. Design shall conform to standards of EJMA and ASME B31.1.
  6. External tie rods designed to withstand pressure thrust force upon anchor failure if one or both anchors for the joint are at change in direction of pipeline.
  7. Integral external cover.
- E. Bellows - Externally Pressurized Type:
1. Multiple corrugations of Type 304 stainless steel.
  2. Internal and external guide integral with joint.
  3. Design for external pressurization of bellows to eliminate squirm.
  4. Welded ends.
  5. Conform to the standards of EJMA and ASME B31.1.
  6. Threaded connection at bottom, 25 mm (one inch) minimum, for drain or drip point.
  7. Integral external cover and internal sleeve.
- F. Expansion Joint Identification: Provide stamped brass or stainless steel nameplate on each expansion joint listing the manufacturer, the allowable movement, flow direction, design pressure and temperature, date of manufacture, and identifying the expansion joint by the identification number on the contract drawings.

**2.9 STEAM SYSTEM COMPONENTS**

- A. Heat Exchanger (Steam to Hot Water): Shell and tube type, U-bend removable tube bundle, steam in shell, water in tubes, equipped with support cradles.
1. Maximum tube velocity: 2.3 m/s (7.5 feet per second).
  2. Tube fouling factor: TEMA Standards, but not less than  $0.00018 \text{ m}^2\text{K/W}$  ( $0.001 \text{ ft}^2\text{hrF/Btu}$ ).
  3. Materials:
    - a. Shell: Steel.
    - b. Tube sheet and tube supports: Steel or brass.
    - c. Tubes: 20 mm (3/4 inch) OD copper.
    - d. Head or bonnet: Cast iron or steel.
  4. Construction: In accordance with ASME Pressure Vessel Code for 861 kPa (125 psig) working pressure for shell and tubes. Provide manufacturer's certified data report, Form No. U-1.
- B. Optional Heat Transfer Package: In lieu of field erected individual components, the Contractor may provide a factory or shop assembled



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package of heat exchangers, pumps, and other components supported on a welded steel frame.

C. Steam Pressure Reducing Valves in PRV Stations:

1. Type: Single-seated, diaphragm operated, spring-loaded, external or internal steam pilot-controlled, normally closed, adjustable set pressure. Pilot shall sense controlled pressure downstream of main valve.
2. Service: Provide controlled reduced pressure to steam piping systems.
3. Pressure control shall be smooth and continuous with maximum drop of 10 percent. Maximum flow capability of each valve shall not exceed capacity of downstream safety valve(s).
4. Main valve and pilot valve shall have replaceable valve plug and seat of stainless steel, monel, or similar durable material.
  - a. Pressure rating for high pressure steam: Not less than 1034 kPa (150 psig) saturated steam.
  - b. Connections: Flanged for valves 65 mm (2-1/2 inches) and larger; flanged or threaded ends for smaller valves.
5. Select pressure reducing valves to develop less than 85 dbA at 1500 mm (5 feet) elevation above adjacent floor, and 1500 mm (5 feet) distance in any direction. Inlet and outlet piping for steam pressure reducing valves shall be Schedule 80 minimum for required distance to achieve required levels or sound attenuators shall be applied.

D. Safety Valves and Accessories: Comply with ASME Boiler and Pressure Vessel Code, Section VIII. Capacities shall be certified by National Board of Boiler and Pressure Vessel Inspectors, maximum accumulation 10 percent. Provide lifting lever. Provide drip pan elbow where shown.

E. Steam PRV for Individual Equipment: Cast iron or bronze body, screwed or flanged ends, rated 861 kPa (125 psig) working pressure. Single-seated, diaphragm operated, spring loaded, adjustable range, all parts renewable.

F. Flash Tanks: Horizontal or vertical vortex type, constructed of copper bearing steel, ASTM A516 or ASTM A285, for a steam working pressure of 861 kPa (125 psig) to comply with ASME Code for Unfired Pressure Vessels and stamped with "U" symbol. Perforated pipe inside tank shall be ASTM A53 Grade B, Seamless or ERW, or A106 Grade B Seamless, Schedule 80. Corrosion allowance of 1.6 mm (1/16 inch) may be provided in lieu of the copper bearing requirement. Provide data Form No. U-1.

G. Steam Trap: Each type of trap shall be the product of a single manufacturer. Provide trap sets at all low points and at 61 m (200 feet) intervals on the horizontal main lines.

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1. Floats and linkages shall provide sufficient force to open trap valve over full operating pressure range available to the system. Unless otherwise indicated on the drawings, traps shall be sized for capacities indicated at minimum pressure drop as follows:
  - a. For equipment with modulating control valve: 1.7 kPa (1/4 psig), based on a condensate leg of 300 mm (12 inches) at the trap inlet and gravity flow to the receiver.
  - b. For main line drip trap sets and other trap sets at steam pressure: Up to 70 percent of design differential pressure.  
Condensate may be lifted to the return line.
2. Trap bodies: Bronze, cast iron, or semi-steel, constructed to permit ease of removal and servicing working parts without disturbing connecting piping. For systems without relief valve traps shall be 5.  
Mechanism: Brass, stainless steel or corrosion resistant alloy.  
rated for the pressure upstream of the PRV supplying the system.
3. Balanced pressure thermostatic elements: Phosphor bronze, stainless steel or monel metal.
4. Valves and seats: Suitable hardened corrosion resistant alloy.
5. Floats: Stainless steel.
6. Inverted bucket traps: Provide bi-metallic thermostatic element for rapid release of non-condensables.
- H. Thermostatic Air Vent (Steam): Brass or iron body, balanced pressure bellows, stainless steel (renewable) valve and seat, rated 861 kPa (125 psig) working pressure, 20 mm (3/4 inch) screwed connections. Air vents shall be balanced pressure type that responds to steam pressure-temperature curve and vents air at any pressure.

**2.10 CLEAN STEAM GENERATOR (CSG-50)**

- A. Fabrication requirements:
  1. Tank and cover: 14-gauge, 304-stainless steel with Heli-arc welded seams
  2. Removable cover with 1/4" screws (M6)
  3. Easily accessible cleanout plate
  4. Steam outlet on top of tank configured to connect to hose, pipe, or flange connection
  5. Tubular copper heat exchanger and header with nickel coating
- B. Mounting:
- C. Water requirements: The humidifier shall be capable of generating steam from tap, softened, or DI/RO water.

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D. Drain: An electric operated drain valve shall be mounted on the humidifier assembly to allow tank to drain automatically at the end of a humidification season.

E. Steam trap and strainer: Humidifier shall include a float/thermostatic steam trap and steam supply line strainer.

F. Fabrication

1. Factory insulation: Humidifier shall be covered with 1" thick (25 mm) rigid, foil-faced fiberglass insulation. All surfaces except front face panel shall have insulation.
2. Humidifier shall have a tubular 316 stainless steel heat exchanger and header with Teflon coating.

G. Mounting

1. Four support legs shall provide a minimum of 24" (610 mm) between underside of humidifier and floor.

H. Control cabinet: Control cabinet shall be shipped loose and shall be a UL/CSA listed JIC enclosure. Control devices shall be mounted on a subpanel within the cabinet. A wiring diagram shall be included in the control cabinet.

I. Microprocessor controller with the following features or functions:

1. Interoperable with any LonTalk® network. The system shall, through the use of Standard Network Variable Types (SNVTs), allow communication with a building automation system (BAS) using the following inputs and outputs:
  - a. Inputs. The following network variable inputs allow the user to set humidifier information via BAS:
    - 1) Set the date and time of day
    - 2) Set humidifier mode (standby, auto, manual drain)
    - 3) Set humidity set point in space being humidified
    - 4) Set the duct high limit set point
    - 5) Set steam output as a percentage of total capacity
    - 6) Set steam output in lbs/hr
  - b. Outputs. The following network variable outputs allow the user to read humidifier information via BAS:

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- 1) Read the humidifier's current date and time
  - 2) Read the current humidifier mode (standby, auto, manual drain)
  - 3) Read the RH of the space being humidified
  - 4) Read the set point of the space being humidified
  - 5) Read the duct RH at the transmitter
  - 6) Read the duct high•limit set point
  - 7) Read the estimated amount of steam the humidifier is producing in percent of total capacity
  - 8) Read the estimated amount of steam the humidifier is producing in lbs/hr
  - 9) Read window glass temperature at transmitter
- c. Configuration properties (inputs). The following network configuration inputs allow the user to set humidifier information via BAS during system configuration:
- 1) Set offset from measured value for window glass temperature
  - 2) Set offset from measured value for space RH
  - 3) Set offset from measured value for duct RH
  - 4) Set PID band value
  - 5) Set PID P gain value
  - 6) Set PID I gain value
  - 7) Set PID D gain value
2. Makeup water switch control and low water safety shutdown
  3. Fully modulating (0% to 100%) control of humidifier outputs
  4. PID control capability
  5. Self•diagnostic test at start•up
  6. Integral fault relay for remote signaling of alarms
  7. A keypad, capable of either unit or remote mounting with a 5' (1.5 m) cable, and able to operate within a temperature range of 32 °F to 122 °F (0 °C to 50 °C)
  8. A keypad that provides text backlighting and allows personal password codes

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9. A keypad capable of monitoring and/or controlling the following parameters:

- a. Relative humidity (RH) set point and actual conditions in the space (from humidity transmitter)
- b. Relative humidity (RH) set point and actual conditions in the duct for variable air volume applications (from duct humidity transmitter)
- c. Relative humidity (RH) high limit set point and actual conditions
- d. Total system demand in % of humidifier capacity
- e. Total system output in lbs/hour (kg/h)
- f. Drain/flush frequency interval and duration
- g. End•of•season drain status (on standard water systems and if ordered as a DI water option)
- h. Window glass surface temperature (in % RH offset application and if ordered as an option)
- i. System alarms
- j. Previous fault messages
- k. Up to 20 humidifier functions, depending on programming
- l. Operating temperature

10. User•adjustable water surface skim duration.

11. Water level control for softened or hard water:

- a. System shall provide for automatic refill, low water cutoff, field adjustable skimmer bleedoff functions, and automatic drain down of humidifier. System shall consist of:
  - 1) A water level sensing unit comprised of three metallic probes screwed into a threaded probe head. Probe head shall incorporate probe isolation chamber to eliminate short•circuiting between probes caused by mineral coating of probe head. Probe head shall be mounted on the humidifier assembly.
  - 2) A solenoid operated fill valve factory mounted on the humidifier assembly

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3) End•of•season drain

12. Temperature sensor: A factory mounted sensor with a temperature range of •40 °F to 248 °F (•40 ° C to 120 °C) shall be mounted on the humidifier to enable the following functions:

- a. Maintain the evaporating chamber water temperature above freezing
- b. Maintain a user defined preset evaporating chamber water temperature
- c. Allow rapid warm up of water in evaporating chamber after a call for humidity, providing 100% operation until system production occurs

J. Control input accessory options:

1. Humidistat, on•off, high limit: Electric humidistat control shall be an off•on style, duct mounted with a control range of 15% to 95% RH. Compatible with 24, 120, 240 VAC. Operating temperature range 40 °F to 125 °F (4 °C to 52 °C).
2. Airflow proving switch, pressure type: Airflow proving switch shall be diaphragm operated with pitot tube for field installation. Switch shall have an adjustable control point range of 0.05" to 12" wc (12.5 Pa to 2,988 Pa). Operating temperature range •40 °F to 180 °F (•40 °C to 82 °C). Compatible with 24, 120, and 240 VAC.

K. Condensate cooler: A thermostatically controlled water valve shall meter an amount of cold water into a stainless steel mixing chamber to temper 212 °F (100 °C) water with a 6 gpm (0.38 L/s) in•flow rate to a 140 °F (60 °C) discharge temperature to sanitary system.

L. Steam dispersion panel (H-50):

1. The steam dispersion panel shall be a packaged steam injection type humidifier or multiple tube dispersion assembly ready for insertion into the duct.
2. The device shall include a fabricated separator/header and multiple dispersion tube design of all stainless steel construction wetted parts; No -rings or slip couplings shall be required. Each active tube shall be fitted with a series of nozzles which extend from the center of the tube. The nozzles shall be sized and spaced to accept steam from the steam generator and provide a dry and uniform discharge of steam.

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3. The packaged humidifier shall provide a non-wetting distance of no more than 24" downstream of the active tube segment while maintaining conditions of 85% relative humidity at a minimum temperature of 55 degree F in the duct airstream. Air pressure drop across dispersion tube segment shall not exceed 0.05" W.C. at a duct air velocity of 1161 FPM.

**2.11 GAGES, PRESSURE AND COMPOUND**

- A. ASME B40.1, Accuracy Grade 1A, (pressure, vacuum, or compound), initial mid-scale accuracy 1 percent of scale (Qualify grade), metal or phenolic case, 115 mm (4-1/2 inches) in diameter, 6 mm (1/4 inch) NPT bottom connection, white dial with black graduations and pointer, clear glass or acrylic plastic window, suitable for board mounting. Provide red "set hand" to indicate normal working pressure.
- B. Provide brass, lever handle union cock. Provide brass/bronze pressure snubber for gages in water service. Provide brass pigtail syphon for steam gages.
- C. Range of Gages: For services not listed provide range equal to at least 130 percent of normal operating range:

Low pressure steam and steam condensate to 103 kPa(15 psig)	0 to 207 kPa (30 psig).
Medium pressure steam and steam condensate nominal 413 kPa (60 psig)	0 to 689 kPa (100 psig).
High pressure steam and steam condensate nominal 620 kPa to 861 kPa (90 to 125 psig)	0 to 1378 kPa (200 psig).
Pumped condensate, steam condensate, gravity or vacuum (30" HG to 30 psig)	0 to 415 kPa (60 psig)

**2.12 PRESSURE/TEMPERATURE TEST PROVISIONS**

- A. Provide one each of the following test items to the Resident Engineer:
1. 6 mm (1/4 inch) FPT by 3 mm (1/8 inch) diameter stainless steel pressure gage adapter probe for extra long test plug. PETE'S 500 XL is an example.
  2. 90 mm (3-1/2 inch) diameter, one percent accuracy, compound gage, 762 mm (30 inches) Hg to 689 kPa (100 psig) range.
  3. 0 - 104 degrees C (32-220 degrees F) pocket thermometer one-half degree accuracy, 25 mm (one inch) dial, 125 mm (5 inch) long stainless steel stem, plastic case.

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**2.13 FIRESTOPPING MATERIAL**

- A. Refer to Section 23 05 11, COMMON WORK RESULTS FOR HVAC AND STEAM GENERATION.

**PART 3 - EXECUTION**

**3.1 GENERAL**

- A. The drawings show the general arrangement of pipe and equipment but do not show all required fittings and offsets that may be necessary to connect pipes to equipment, fan-coils, coils, radiators, etc., and to coordinate with other trades. Provide all necessary fittings, offsets and pipe runs based on field measurements and at no additional cost to the government. Coordinate with other trades for space available and relative location of HVAC equipment and accessories to be connected on ceiling grid. Pipe location on the drawings shall be altered by contractor where necessary to avoid interferences and clearance difficulties.
- B. Store materials to avoid excessive exposure to weather or foreign materials. Keep inside of piping relatively clean during installation and protect open ends when work is not in progress.
- C. Support piping securely. Refer to PART 3, Section 23 05 11, COMMON WORK RESULTS FOR HVAC AND STEAM GENERATION. Install convertors and other heat exchangers at height sufficient to provide gravity flow of condensate to the flash tank and condensate pump.
- D. Install piping generally parallel to walls and column center lines, unless shown otherwise on the drawings. Space piping, including insulation, to provide 25 mm (one inch) minimum clearance between adjacent piping or other surface. Unless shown otherwise, slope steam, condensate and drain piping down in the direction of flow not less than 25 mm (one inch) in 12 m (40 feet). Provide eccentric reducers to keep bottom of sloped piping flat.
- E. Locate and orient valves to permit proper operation and access for maintenance of packing, seat and disc. Generally locate valve stems in overhead piping in horizontal position. Provide a union adjacent to one end of all threaded end valves. Control valves usually require reducers to connect to pipe sizes shown on the drawing. Install butterfly valves with the valve open as recommended by the manufacturer to prevent binding of the disc in the seat.
- F. Offset equipment connections to allow valving off for maintenance and repair with minimal removal of piping. Provide flexibility in equipment connections and branch line take-offs with 3-elbow swing joints where noted on the drawings.



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- G. Tee water piping runouts or branches into the side of mains or other branches. Avoid bull-head tees, which are two return lines entering opposite ends of a tee and exiting out the common side.
- H. Connect piping to equipment as shown on the drawings. Install components furnished by others such as:
  - 1. Flow elements (orifice unions), control valve bodies, flow switches, pressure taps with valve, and wells for sensors.
- I. Firestopping: Fill openings around uninsulated piping penetrating floors or fire walls, with firestop material. For firestopping insulated piping refer to Section 23 07 11, HVAC, PLUMBING, and BOILER PLANT INSULATION.
- J. Where copper piping is connected to steel piping, provide dielectric connections.
- K. Pipe vents to the exterior. Where a combined vent is provided, the cross sectional area of the combined vent shall be equal to sum of individual vent areas. Slope vent piping one inch in 40 feet (0.25 percent) in direction of flow. Provide a drip trap elbow on relief valve outlets if the vent rises to prevent backpressure. Terminate vent within the exhaust air plenum with down turned elbow.

**3.2 PIPE JOINTS**

- A. Welded: Beveling, spacing and other details shall conform to ASME B31.1 and AWS B2.1. See Welder's qualification requirements under "Quality Assurance" in Section 23 05 11, COMMON WORK RESULTS FOR HVAC and STEAM GENERATION.
- B. Screwed: Threads shall conform to ASME B1.20; joint compound shall be applied to male threads only and joints made up so no more than three threads show. Coat exposed threads on steel pipe with joint compound, or red lead paint for corrosion protection.
- C. 125 Pound Cast Iron Flange (Plain Face): Mating flange shall have raised face, if any, removed to avoid overstressing the cast iron flange.

**3.3 STEAM TRAP PIPING**

- A. Install to permit gravity flow to the trap. Provide gravity flow (avoid lifting condensate) from the trap where modulating control valves are used. Support traps weighing over 11 kg (25 pounds) independently of connecting piping.

**3.4 SEISMIC BRACING**

- A. Provide in accordance with Section 13 05 41, SEISMIC RESTRAINT REQUIREMENTS FOR NON-STRUCTURAL COMPONENTS.

**3.5 LEAK TESTING**

- A. Inspect all joints and connections for leaks and workmanship and make corrections as necessary, to the satisfaction of the Resident Engineer

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in accordance with the specified requirements. Testing shall be performed in accordance with the specification requirements.

- B. An operating test at design pressure, and for hot systems, design maximum temperature.
- C. A hydrostatic test at 1.5 times design pressure. For water systems the design maximum pressure would usually be the static head, or expansion tank maximum pressure, plus pump head. Factory tested equipment (convertors, exchangers, coils, etc.) need not be field tested. Avoid excessive pressure on mechanical seals and safety devices.

**3.6 FLUSHING AND CLEANING PIPING SYSTEMS**

- A. Steam, Condensate and Vent Piping: No flushing or chemical cleaning required. Accomplish cleaning by pulling all strainer screens and cleaning all scale/dirt legs during start-up operation.

**3.7 OPERATING AND PERFORMANCE TEST AND INSTRUCTION**

- A. Refer to PART 3, Section 23 05 11, COMMON WORK RESULTS FOR HVAC and STEAM GENERATION.
- B. Adjust red set hand on pressure gages to normal working pressure.

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SECTION 23 25 00  
HVAC WATER TREATMENT

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

- A. This section specifies cleaning and treatment of circulating HVAC water systems, including the following.
  - 1. Cleaning compounds.
  - 2. Chemical treatment for closed loop heat transfer systems.
  - 3. Glycol-water heat transfer systems.

**1.2 RELATED WORK**

- A. Test requirements and instructions on use of equipment/system: Section 01 00 00, GENERAL REQUIREMENTS.
- B. General mechanical requirements and items, which are common to more than one section of Division 23: Section 23 05 11, COMMON WORK RESULTS FOR HVAC and STEAM GENERATION.
- C. Piping and valves: Section 23 21 13, HYDRONIC PIPING and Section 23 22 13, STEAM and CONDENSATE HEATING PIPING.

**1.3 QUALITY ASSURANCE**

- A. Refer to paragraph, QUALITY ASSURANCE in Section 23 05 11, COMMON WORK RESULTS FOR HVAC and STEAM GENERATION.
- B. Technical Services: Provide the services of an experienced water treatment chemical engineer or technical representative to direct flushing, cleaning, pre-treatment, training, debugging, and acceptance testing operations; direct and perform chemical limit control during construction period and monitor systems for a period of 12 months after acceptance, including not less than 6 service calls and written status reports. Emergency calls are not included. //During this period perform monthly tests of the cooling tower for Legionella pneumophila and submit reports stating Legionella bacteria count per millimeter. These tests shall be conducted in a certified laboratory and not by a technician in the field.// Minimum service during construction/start-up shall be 6 hours.
- C. Chemicals: Chemicals shall be non-toxic approved by local authorities and meeting applicable EPA requirements.

**1.4 SUBMITTALS**

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, and SAMPLES.

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- B. Manufacturer's Literature and Data including:
  - 1. Cleaning compounds and recommended procedures for their use.
  - 2. Chemical treatment for closed systems, including installation and operating instructions.
  - 3. Glycol-water system materials, equipment, and installation.
- C. Water analysis verification.
- D. Materials Safety Data Sheet for all proposed chemical compounds, based on U.S. Department of Labor Form No. L5B-005-4.
- E. Maintenance and operating instructions in accordance with Section 01 00 00, GENERAL REQUIREMENTS.

**1.5 APPLICABLE PUBLICATIONS**

- A. The publication listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.
- B. National Fire Protection Association (NFPA):  
70-2008 .....National Electric Code (NEC)
- C. American Society for Testing and Materials (ASTM):  
F441/F441M-02 (2008) ... Standard Specification for Chlorinated Poly  
(Vinyl Chloride) (CPVC) Plastic Pipe, Schedules  
40 and 80

**PART 2 - PRODUCTS**

**2.1 CLEANING COMPOUNDS**

- A. Alkaline phosphate or non-phosphate detergent/surfactant/specific to remove organic soil, hydrocarbons, flux, pipe mill varnish, pipe compounds, iron oxide, and like deleterious substances, with or without inhibitor, suitable for system wetted metals without deleterious effects.
- B. All chemicals to be acceptable for discharge to sanitary sewer.
- C. Refer to Section 23 21 13, HYDRONIC PIPING and Section 23 22 13, STEAM and CONDENSATE HEATING PIPING, PART 3, for flushing and cleaning procedures.

**2.2 CHEMICAL TREATMENT FOR CLOSED LOOP SYSTEMS**

- A. Inhibitor: Provide sodium nitrite/borate, molybdate-based inhibitor or other approved compound suitable for make-up quality and make-up rate and which will cause or enhance bacteria/corrosion problems or mechanical seal failure due to excessive total dissolved solids. Shot feed manually. Maintain inhibitor residual as determined by water

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treatment laboratory, taking into consideration residual and temperature effect on pump mechanical seals.

- B. pH Control: Inhibitor formulation shall include adequate buffer to maintain pH range of 8.0 to 10.5.
- C. Performance: Protect various wetted, coupled, materials of construction including ferrous, and red and yellow metals. Maintain system essentially free of scale, corrosion, and fouling. Corrosion rate of following metals shall not exceed specified mills per year penetration; ferrous, 0-2; brass, 0-1; copper, 0-1. Inhibitor shall be stable at equipment skin surface temperatures and bulk water temperatures of not less than 121 degrees C (250 degrees F) and 52 degrees C (125 degrees Fahrenheit) respectively. Heat exchanger fouling and capacity reduction shall not exceed that allowed by fouling factor 0.0005.
- D. Pot Feeder: By-pass type, complete with necessary shut off valves, drain and air release valves, and system connections, for introducing chemicals into system, cast iron or steel tank with funnel or large opening on top for easy chemical addition. Feeders shall be 18.9 L (five gallon) minimum capacity at 860 kPa (125 psig) minimum working pressure.

**2.3 GLYCOL-WATER SYSTEM**

- A. Propylene glycol shall be inhibited with 1.75 percent dipotassium phosphate. Do not use automotive anti-freeze because the inhibitors used are not needed and can cause sludge precipitate that interferes with heat transfer.
- B. Provide required amount of glycol to obtain the percent by volume for glycol-water systems as follows and to provide one-half tank reserve supply: 30 percent for glycol preheat hydronic system.
- C. Pot Feeder Make-up Unit: By pass type for chemical treatment, schedule 3.5 mm (10 gauge) heads, 20 mm (3/4-inch) system connections and large neck opening for chemical addition. Feeders shall be 19 Liters (5 gallon) minimum size.

**2.4 EQUIPMENT AND MATERIALS IDENTIFICATION**

Refer to Section 23 05 11, COMMON WORK RESULTS FOR HVAC and STEAM GENERATION.

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**PART 3 - EXECUTION**

**3.1 INSTALLATION**

- A. Delivery and Storage: Deliver all chemicals in manufacturer's sealed shipping containers. Store in designated space and protect from deleterious exposure and hazardous spills.
- B. Install equipment furnished by the chemical treatment supplier and charge systems according to the manufacturer's instructions and as directed by the Technical Representative.
- C. Refer to Section 23 21 13 HYDRONIC PIPING for chemical treatment piping, installed as follows:
  - 1. Provide a by-pass line around water meters and bleed off piping assembly. Provide ball valves to allow for bypassing, isolation, and servicing of components.
  - 2. Bleed off water piping with bleed off piping assembly shall be piped from pressure side of circulating water piping to a convenient drain. Bleed off connection to main circulating water piping shall be upstream of chemical injection nozzles.
  - 3. Provide piping for the flow assembly piping to the main control panel and accessories.
    - a. The inlet piping shall connect to the discharge side of the circulating water pump.
    - b. The outlet piping shall connect to the water piping serving the cooling tower downstream of the heat source.
    - c. Provide inlet Y-strainer and ball valves to isolate and service main control panel and accessories.
  - 4. Install injection nozzles with corporation stops in the water piping serving the cooling tower downstream of the heat source.
  - 5. Provide piping for corrosion monitor rack per manufacturer's installation instructions. Provide ball valves to isolate and service rack.
  - 6. Provide installation supervision, start-up and operating instruction by manufacturer's technical representative.
- D. Before adding cleaning chemical to the closed system, all air handling coils and fan coil units should be isolated by closing the inlet and outlet valves and opening the bypass valves. This is done to prevent dirt and solids from lodging the coils.

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- E. Do not valve in or operate system pumps until after system has been cleaned.
- F. After chemical cleaning is satisfactorily completed, open the inlet and outlet valves to each coil and close the by-pass valves. Also, clean all strainers.
- G. Perform tests and report results in accordance with Section 01 00 00, GENERAL REQUIREMENTS.
- H. After cleaning is complete, and water PH is acceptable to manufacturer of water treatment chemical, add manufacturer-recommended amount of chemicals to systems.
- I. Instruct VA personnel in system maintenance and operation in accordance with Section 01 00 00, GENERAL REQUIREMENTS.

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SECTION 23 31 00  
HVAC DUCTS AND CASINGS

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Ductwork and accessories for HVAC including the following:
  - 1. Supply air, return air, outside air, exhaust, make-up air, and relief systems.
- B. Definitions:
  - 1. SMACNA Standards as used in this specification means the HVAC Duct Construction Standards, Metal and Flexible.
  - 2. Seal or Sealing: Use of liquid or mastic sealant, with or without compatible tape overlay, or gasketing of flanged joints, to keep air leakage at duct joints, seams and connections to an acceptable minimum.
  - 3. Duct Pressure Classification: SMACNA HVAC Duct Construction Standards, Metal and Flexible.
  - 4. Exposed Duct: Exposed to view in a finished room.

1.2 RELATED WORK

- A. Fire Stopping Material: Section 07 84 00, FIRESTOPPING.
- B. Outdoor and Exhaust Louvers: Section 08 90 00, LOUVERS and VENTS.
- C. Seismic Reinforcing: Section 13 05 41, SEISMIC RESTRAINT REQUIREMENTS FOR NON-STRUCTURAL COMPONENTS.//
- D. General Mechanical Requirements: Section 23 05 11, COMMON WORK RESULTS FOR HVAC and STEAM GENERATION.
- E. Noise Level Requirements: Section 23 05 41, NOISE AND VIBRATION CONTROL FOR HVAC PIPING and EQUIPMENT.
- F. Duct Insulation: Section 23 07 11, HVAC, PLUMBING, and BOILER PLANT INSULATION
- G. Air Flow Control Valves and Terminal Units: Section 23 36 00, AIR TERMINAL UNITS.
- H. Duct Mounted Coils: Section 23 82 16, AIR COILS.
- I. Supply Air Fans: Section 23 73 00, INDOOR CENTRAL-STATION AIR-HANDLING UNITS.
- J. Return Air and Exhaust Air Fans: Section 23 34 00, HVAC FANS.
- K. Air Filters and Filters' Efficiencies: Section 23 40 00, HVAC AIR CLEANING DEVICES.
- L. Duct Mounted Instrumentation: Section 23 09 23, DIRECT-DIGITAL CONTROL SYSTEM FOR HVAC.

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M. Testing and Balancing of Air Flows: Section 23 05 93, TESTING, ADJUSTING, and BALANCING FOR HVAC.

N. Smoke Detectors: Section 28 31 00, FIRE DETECTION and ALARM.

**1.3 QUALITY ASSURANCE**

A. Refer to article, QUALITY ASSURANCE, in Section 23 05 11, COMMON WORK RESULTS FOR HVAC and STEAM GENERATION.

B. Fire Safety Code: Comply with NFPA 90A.

C. Duct System Construction and Installation: Referenced SMACNA Standards are the minimum acceptable quality.

D. Duct Sealing, Air Leakage Criteria, and Air Leakage Tests: Ducts shall be sealed as per duct sealing requirements of SMACNA HVAC Air Duct Leakage Test Manual for duct pressure classes shown on the drawings.

E. Duct accessories exposed to the air stream, such as dampers of all types (except smoke dampers) and access openings, shall be of the same material as the duct or provide at least the same level of corrosion resistance.

**1.4 SUBMITTALS**

A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, and SAMPLES.

B. Manufacturer's Literature and Data:

1. Rectangular ducts:

a. Schedules of duct systems, materials and selected SMACNA construction alternatives for joints, sealing, gage and reinforcement.

b. Duct liner.

c. Sealants and gaskets.

d. Access doors.

2. Round and flat oval duct construction details:

a. Manufacturer's details for duct fittings.

b. Duct liner.

c. Sealants and gaskets.

d. Access sections.

e. Installation instructions.

3. Volume dampers, back draft dampers.

4. Upper hanger attachments.

5. Fire dampers, fire doors, and smoke dampers with installation instructions.

6. Sound attenuators, including pressure drop and acoustic performance.

7. Flexible ducts and clamps, with manufacturer's installation instructions.

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- 8. Flexible connections.
  - 9. Instrument test fittings.
  - 10 Details and design analysis of alternate or optional duct systems.
  - 11 COMMON WORK RESULTS FOR HVAC and STEAM GENERATION.
- C. Coordination Drawings: Refer to article, SUBMITTALS, in Section 23 05 11  
- Common Work Results for HVAC and Steam Generation.

**1.5 APPLICABLE PUBLICATIONS**

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.
- B. American Society of Civil Engineers (ASCE):
  - ASCE7-05 .....Minimum Design Loads for Buildings and Other Structures
- C. American Society for Testing and Materials (ASTM):
  - A167-99(2009) .....Standard Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip
  - A653-09 .....Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy coated (Galvannealed) by the Hot-Dip process
  - A1011-09a .....Standard Specification for Steel, Sheet and Strip, Hot rolled, Carbon, structural, High-Strength Low-Alloy, High Strength Low-Alloy with Improved Formability, and Ultra-High Strength
  - B209-07 .....Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate
  - C1071-05e1 .....Standard Specification for Fibrous Glass Duct Lining Insulation (Thermal and Sound Absorbing Material)
  - E84-09a .....Standard Test Method for Surface Burning Characteristics of Building Materials
- D. National Fire Protection Association (NFPA):
  - 90A-09 .....Standard for the Installation of Air Conditioning and Ventilating Systems
- E. Sheet Metal and Air Conditioning Contractors National Association (SMACNA):
  - 2nd Edition - 2005 .....HVAC Duct Construction Standards, Metal and Flexible
  - 1st Edition - 1985 .....HVAC Air Duct Leakage Test Manual

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F. Underwriters Laboratories, Inc. (UL):

181-08 .....Factory-Made Air Ducts and Air Connectors

555-06 .....Standard for Fire Dampers

555S-06 .....Standard for Smoke Dampers

**PART 2 - PRODUCTS**

**2.1 DUCT MATERIALS AND SEALANTS**

- A. General: Except for systems specified otherwise, construct ducts, casings, and accessories of galvanized sheet steel, ASTM A653, coating G90; or, aluminum sheet, ASTM B209, alloy 1100, 3003 or 5052.
- B. Specified Corrosion Resistant Systems: Stainless steel sheet, ASTM A167, Class 302 or 304, Condition A (annealed) Finish No. 4 for exposed ducts and Finish No. 2B for concealed duct or ducts located in mechanical rooms.
- C. Joint Sealing: Refer to SMACNA HVAC Duct Construction Standards, paragraph S1.9.
1. Sealant: Elastomeric compound, gun or brush grade, maximum 25 flame spread and 50 smoke developed (dry state) compounded specifically for sealing ductwork as recommended by the manufacturer. Generally provide liquid sealant, with or without compatible tape, for low clearance slip joints and heavy, permanently elastic, mastic type where clearances are larger. Oil base caulking and glazing compounds are not acceptable because they do not retain elasticity and bond.
  2. Tape: Use only tape specifically designated by the sealant manufacturer and apply only over wet sealant. Pressure sensitive tape shall not be used on bare metal or on dry sealant.
  3. Gaskets in Flanged Joints: Soft neoprene.
- D. Approved factory made joints may be used.

**2.2 DUCT CONSTRUCTION AND INSTALLATION**

- A. Regardless of the pressure classifications outlined in the SMACNA Standards, fabricate and seal the ductwork in accordance with the following pressure classifications (see General Notes on duct drawings):
- B. Duct Pressure Classification:
- 0 to 50 mm (2 inch)-provide 2 inch
  - > 50 mm to 75 mm (2 inch to 3 inch)-provide 3 inch
  - > 75 mm to 100 mm (3 inch to 4 inch)-provide 4 inch
  - > 100mm to 125mm (4 to 5 inch)-provide 5 inch
  - > 125mm to 150mm (5 to 6 inch)-provide 6 inch
- Show pressure classifications on the floor plans.
- C. Seal Class: All ductwork shall receive Class A Seal
- D. Duct for Negative Pressure Up to 750 Pa (3 inch W.G.):

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1. Round Duct: Galvanized steel, spiral lock seam construction with standard slip joints.
  2. Rectangular Duct: Galvanized steel, minimum 1.0 mm (20 gage), Pittsburgh lock seam, companion angle joints 32 mm by 3.2 mm (1-1/4 by 1/8 inch) minimum at not more than 2.4 m (8 feet) spacing. Approved pre-manufactured joints are acceptable in lieu of companion angles.
- E. Round and Flat Oval Ducts: Furnish duct and fittings made by the same manufacturer to insure good fit of slip joints. When submitted and approved in advance, round and flat oval duct, with size converted on the basis of equal pressure drop, may be furnished in lieu of rectangular duct design shown on the drawings.
1. Elbows: Diameters 80 through 200 mm (3 through 8 inches) shall be two sections die stamped, all others shall be gored construction, maximum 18 degree angle, with all seams continuously welded or standing seam. Coat galvanized areas of fittings damaged by welding with corrosion resistant aluminum paint or galvanized repair compound.
  2. Provide bell mouth, conical tees or taps, laterals, reducers, and other low loss fittings as shown in SMACNA HVAC Duct Construction Standards.
  3. Ribbed Duct Option: Lighter gage round/oval duct and fittings may be furnished provided certified tests indicating that the rigidity and performance is equivalent to SMACNA standard gage ducts are submitted.
    - a. Ducts: Manufacturer's published standard gage, G90 coating, spiral lock seam construction with an intermediate standing rib.
    - b. Fittings: May be manufacturer's standard as shown in published catalogs, fabricated by spot welding and bonding with neoprene base cement or machine formed seam in lieu of continuous welded seams.
  4. Provide flat side reinforcement of oval ducts as recommended by the manufacturer and SMACNA HVAC Duct Construction Standard S3.13. Because of high pressure loss, do not use internal tie-rod reinforcement unless approved by the Resident Engineer.
- F. Casings and Plenums: Construct in accordance with SMACNA HVAC Duct Construction Standards Section 6, including curbs, access doors, pipe penetrations, eliminators and drain pans. Access doors shall be hollow metal, insulated, with latches and door pulls, 500 mm (20 inches) wide by 1200 - 1350 mm (48 - 54 inches) high. Provide view port in the doors where shown. Provide drain for outside air louver plenum. Outside air

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plenum shall have exterior insulation. Drain piping shall be routed to the nearest floor drain.

- G. Volume Dampers: Single blade or opposed blade, multi-louver type as detailed in SMACNA Standards. Refer to SMACNA Detail Figure 2-12 for Single Blade and Figure 2.13 for Multi-blade Volume Dampers.
- H. Duct Hangers and Supports: Refer to SMACNA Standards Section IV. Avoid use of trapeze hangers for round duct.

**2.3 DUCT LINER (WHERE INDICATED ON DRAWINGS)**

- A. Duct sizes shown on drawings for lined duct are clear opening inside lining.
- B. Duct liner is only permitted to be used for return, relief and general exhaust ducts. Duct liner is not permitted for outside air ducts, supply air ducts or any other positive pressure ductwork (provide exterior insulation only).
- C. Rectangular Duct or Casing Liner: ASTM C1071, Type I (flexible), or Type II (board), 25 mm (one inch) minimum thickness, applied with mechanical fasteners and 100 percent coverage of adhesive in conformance with SMACNA, Duct Liner Application Standard.
- D. Round and Oval Duct Liner: Factory fabricated double-walled with one inch thick sound insulation and inner perforated galvanized metal liner. Construction shall comply with flame and smoke rating required by NFPA 90A. Metal liner shall be 1.0 to 0.60 mm (20 to 24 gage) having perforations not exceeding 2.4 mm (3/32 inch) diameter and approximately 22 percent free area. Metal liner for fittings need not be perforated. Assemblies shall be complete with continuous sheet Mylar liner, 2 mil thickness, between the perforated liner and the insulation to prevent erosion of the insulation. Provide liner couplings/spacer for metal liner. At the end of insulated sections, provide insulation end fittings to reduce outer shell to liner size. Provide liner spacing/concentricity leaving airway unobstructed.

**2.4 DUCT ACCESS DOORS, PANELS AND SECTIONS**

- A. Provide access doors, sized and located for maintenance work, upstream, in the following locations:
  - 1. Each duct mounted coil and humidifier.
  - 2. Each fire damper (for link service), smoke damper and automatic control damper.
  - 3. Each duct mounted smoke detector.
- B. Openings shall be as large as feasible in small ducts, 300 mm by 300 mm (12 inch by 12 inch) minimum where possible. Access sections in

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insulated ducts shall be double-wall, insulated. Transparent shatterproof covers are preferred for uninsulated ducts.

1. For rectangular ducts: Refer to SMACNA HVAC Duct Construction Standards (Figure 2-12).
2. For round and flat oval duct: Refer to SMACNA HVAC duct Construction Standards (Figure 2-11).

**2.5 FIRE DAMPERS**

- A. Galvanized steel, interlocking blade type, UL listing and label, 1-1/2 hour rating, 70 degrees C (160 degrees F) fusible line, 100 percent free opening with no part of the blade stack or damper frame in the air stream.
- B. Fire dampers in wet air exhaust shall be of stainless steel construction, all others may be galvanized steel.
- C. Minimum requirements for fire dampers:
  1. The damper frame may be of design and length as to function as the mounting sleeve, thus eliminating the need for a separate sleeve, as allowed by UL 555. Otherwise provide sleeves and mounting angles, minimum 1.9 mm (14 gage), required to provide installation equivalent to the damper manufacturer's UL test installation.
  2. Submit manufacturer's installation instructions conforming to UL rating test.

**2.6 SMOKE DAMPERS**

- A. Maximum air velocity, through free area of open damper, and pressure loss: Low pressure and medium pressure duct (supply, return, exhaust, outside air): 450 m/min (1500 fpm). Maximum static pressure loss: 32 Pa (0.13 inch W.G.).
- B. Maximum air leakage, closed damper: 0.32 cubic meters /min/square meter (4.0 CFM per square foot) at 750 Pa (3 inch W.G.) differential pressure.
- C. Minimum requirements for dampers:
  1. Shall comply with requirements of Table 6-1 of UL 555S, except for the Fire Endurance and Hose Stream Test.
  2. Frame: Galvanized steel channel with side, top and bottom stops or seals.
  3. Blades: Galvanized steel, parallel type preferably, 300 mm (12 inch) maximum width, edges sealed with neoprene, rubber or felt, if required to meet minimum leakage. Airfoil (streamlined) type for minimum noise generation and pressure drop are preferred for duct mounted dampers.
  4. Shafts: Galvanized steel.
  5. Bearings: Nylon, bronze sleeve or ball type.



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6. Hardware: Zinc plated.

7. Operation: Automatic open/close. No smoke damper that requires manual reset or link replacement after actuation is acceptable. See drawings for required control operation.

D. Motor operator (actuator): Provide pneumatic or electric as required by the automatic control system, externally mounted on stand-offs to allow complete insulation coverage.

**2.7 COMBINATION FIRE AND SMOKE DAMPERS**

Combination fire and smoke dampers: Multi-blade type units meeting all requirements of both fire dampers and smoke dampers shall be used where shown and may be used at the Contractor's option where applicable.

**2.8 FIRE DOORS**

Galvanized steel, interlocking blade type, UL listing and label, 71 degrees C (160 degrees F) fusible link, 3 hour rating and approved for openings in Class A fire walls with rating up to 4 hours, 100 percent free opening with no part of the blade stack or damper frame in the air stream.

**2.9 FLEXIBLE AIR DUCT**

A. General: Factory fabricated, complying with NFPA 90A for connectors not passing through floors of buildings. Flexible ducts shall not penetrate any fire or smoke barrier which is required to have a fire resistance rating of one hour or more. Flexible duct length shall not exceed 1.5 m (5 feet). Provide insulated acoustical air duct connectors in supply air duct systems and elsewhere as shown.

B. Flexible ducts shall be listed by Underwriters Laboratories, Inc., complying with UL 181. Ducts larger than 200 mm (8 inches) in diameter shall be Class 1. Ducts 200 mm (8 inches) in diameter and smaller may be Class 1 or Class 2.

C. Insulated Flexible Air Duct: Factory made including mineral fiber insulation with maximum C factor of 0.25 at 24 degrees C (75 degrees F) mean temperature, encased with a low permeability moisture barrier outer jacket, having a puncture resistance of not less than 50 Beach Units. Acoustic insertion loss shall not be less than 3 dB per 300 mm (foot) of straight duct, at 500 Hz, based on 150 mm (6 inch) duct, of 750 m/min (2500 fpm).

D. Application Criteria:

1. Temperature range: -18 to 93 degrees C (0 to 200 degrees F) internal.
2. Maximum working velocity: 1200 m/min (4000 feet per minute).
3. Minimum working pressure, inches of water gage: 2500 Pa (10 inches) positive, 500 Pa (2 inches) negative.

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- E. Duct Clamps: 100 percent nylon strap, 80 kg (175 pounds) minimum loop tensile strength manufactured for this purpose or stainless steel strap with cadmium plated worm gear tightening device. Apply clamps with sealant and as approved for UL 181, Class 1 installation.

**2.10 FLEXIBLE DUCT CONNECTIONS**

Where duct connections are made to fans, air terminal units, and air handling units, install a non-combustible flexible connection of 822 g (29 ounce) neoprene coated fiberglass fabric approximately 150 mm (6 inches) wide. For connections exposed to sun and weather provide hypalon coating in lieu of neoprene. Burning characteristics shall conform to NFPA 90A. Securely fasten flexible connections to round ducts with stainless steel or zinc-coated iron draw bands with worm gear fastener. For rectangular connections, crimp fabric to sheet metal and fasten sheet metal to ducts by screws 50 mm (2 inches) on center. Fabric shall not be stressed other than by air pressure. Allow at least 25 mm (one inch) slack to insure that no vibration is transmitted.

**2.11 SOUND ATTENUATING UNITS**

- A. Casing, not less than 1.0 mm (20 gage) galvanized sheet steel, or 1.3 mm (18 gage) aluminum fitted with suitable flanges to make clean airtight connections to ductwork. Sound-absorbent material faced with glass fiber cloth and covered with not less than 0.6 mm (24 gage) or heavier galvanized perforated sheet steel, or 0.85 mm (22 gage) or heavier perforated aluminum. Perforations shall not exceed 4 mm (5/32-inch) diameter, approximately 25 percent free area. Sound absorbent material shall be long glass fiber acoustic blanket meeting requirements of NFPA 90A.
- B. Entire unit shall be completely air tight and free of vibration and buckling at internal static pressures up to 2000 Pa (8 inches W.G.) at operating velocities.
- C. Pressure drop through each unit: Not to exceed indicated value at design air quantities indicated.
- D. Submit complete independent laboratory test data showing pressure drop and acoustical performance.
- E. Cap open ends of attenuators at factory with plastic, heavy duty paper, cardboard, or other appropriate material to prevent entrance of dirt, water, or any other foreign matter to inside of attenuator. Caps shall not be removed until attenuator is installed in duct system.

**2.12 FIRESTOPPING MATERIAL**

Refer to Section 07 84 00, FIRESTOPPING.

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**2.13 SEISMIC RESTRAINT FOR DUCTWORK**

Refer to Section 13 05 41, SEISMIC RESTRAINT REQUIREMENTS FOR NON-STRUCTURAL COMPONENTS.//

**2.14 DUCT MOUNTED THERMOMETER (AIR)**

- A. Stem Type Thermometers: ASTM E1, 7 inch scale, red appearing mercury, lens front tube, cast aluminum case with enamel finish and clear glass or polycarbonate window, brass stem, 2 percent of scale accuracy to ASTM E77 scale calibrated in degrees Fahrenheit.
- B. Thermometer Supports:
  - 1. Socket: Brass separable sockets for thermometer stems with or without extensions as required, and with cap and chain.
  - 2. Flange: 3 inch outside diameter reversible flange, designed to fasten to sheet metal air ducts, with brass perforated stem.

**2.15 DUCT MOUNTED TEMPERATURE SENSOR (AIR)**

Refer to Section 23 09 23, DIRECT-DIGITAL CONTROL SYSTEM FOR HVAC.

**2.16 INSTRUMENT TEST FITTINGS**

- A. Manufactured type with a minimum 50 mm (two inch) length for insulated duct, and a minimum 25 mm (one inch) length for duct not insulated. Test hole shall have a flat gasket for rectangular ducts and a concave gasket for round ducts at the base, and a screw cap to prevent air leakage.
- B. Provide instrument test holes at each duct or casing mounted temperature sensor or transmitter, and at entering and leaving side of each heating coil, cooling coil, and heat recovery unit.

**2.17 AIR FLOW CONTROL VALVES (AFCV)**

Refer to Section 23 36 00 / 23 82 00, AIR TERMINAL UNITS / CONVECTION HEATING and COOLING UNITS.

**PART 3 - EXECUTION**

**3.1 INSTALLATION**

- A. Comply with provisions of Section 23 05 11, COMMON WORK RESULTS FOR HVAC and STEAM GENERATION, particularly regarding coordination with other trades and work in existing buildings.
- B. Fabricate and install ductwork and accessories in accordance with referenced SMACNA Standards:
  - 1. Drawings show the general layout of ductwork and accessories but do not show all required fittings and offsets that may be necessary to connect ducts to equipment, boxes, diffusers, grilles, etc., and to coordinate with other trades. Fabricate ductwork based on field measurements. Provide all necessary fittings and offsets at no additional cost to the government. Coordinate with other trades for space available and relative location of HVAC equipment and

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- accessories on ceiling grid. Duct sizes on the drawings are inside dimensions which shall be altered by Contractor to other dimensions with the same air handling characteristics where necessary to avoid interferences and clearance difficulties.
2. Provide duct transitions, offsets and connections to dampers, coils, and other equipment in accordance with SMACNA Standards, Section II. Provide streamliner, when an obstruction cannot be avoided and must be taken in by a duct. Repair galvanized areas with galvanizing repair compound.
  3. Provide bolted construction and tie-rod reinforcement in accordance with SMACNA Standards.
  4. Construct casings, eliminators, and pipe penetrations in accordance with SMACNA Standards, Chapter 6. Design casing access doors to swing against air pressure so that pressure helps to maintain a tight seal.
- C. Install duct hangers and supports in accordance with SMACNA Standards, Chapter 4.
- D. Install fire dampers, smoke dampers and combination fire/smoke dampers in accordance with the manufacturer's instructions to conform to the installation used for the rating test. Install fire dampers, smoke dampers and combination fire/smoke dampers at locations indicated and where ducts penetrate fire rated and/or smoke rated walls, shafts and where required by the Resident Engineer. Install with required perimeter mounting angles, sleeves, breakaway duct connections, corrosion resistant springs, bearings, bushings and hinges per UL and NFPA. Demonstrate re-setting of fire dampers and operation of smoke dampers to the Resident Engineer.
- E. Seal openings around duct penetrations of floors and fire rated partitions with fire stop material as required by NFPA 90A.
- F. Flexible duct installation: Refer to SMACNA Standards, Chapter 3. Ducts shall be continuous, single pieces not over 1.5 m (5 feet) long (NFPA 90A), as straight and short as feasible, adequately supported. Centerline radius of bends shall be not less than two duct diameters. Make connections with clamps as recommended by SMACNA. Clamp per SMACNA with one clamp on the core duct and one on the insulation jacket. Flexible ducts shall not penetrate floors, or any chase or partition designated as a fire or smoke barrier, including corridor partitions fire rated one hour or two hour. Support ducts SMACNA Standards.
- G. Where diffusers, registers and grilles cannot be installed to avoid seeing inside the duct, paint the inside of the duct with flat black paint to reduce visibility.

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**H. Control Damper Installation:**

1. Provide necessary blank-off plates required to install dampers that are smaller than duct size. Provide necessary transitions required to install dampers larger than duct size.
2. Assemble multiple sections dampers with required interconnecting linkage and extend required number of shafts through duct for external mounting of damper motors.
3. Provide necessary sheet metal baffle plates to eliminate stratification and provide air volumes specified. Locate baffles by experimentation, and affix and seal permanently in place, only after stratification problem has been eliminated.
4. Install all damper control/adjustment devices on stand-offs to allow complete coverage of insulation.

**I. Air Flow Measuring Devices (AFMD):** Install units with minimum straight run distances, upstream and downstream as recommended by the manufacturer.

**J. Low Pressure Duct Liner:** Install in accordance with SMACNA, Duct Liner Application Standard.

**K. Protection and Cleaning:** Adequately protect equipment and materials against physical damage. Place equipment in first class operating condition, or return to source of supply for repair or replacement, as determined by Resident Engineer. Protect equipment and ducts during construction against entry of foreign matter to the inside and clean both inside and outside before operation and painting. When new ducts are connected to existing ductwork, clean both new and existing ductwork by mopping and vacuum cleaning inside and outside before operation.

**3.2 DUCT LEAKAGE TESTS AND REPAIR**

- A. Ductwork leakage testing shall be performed by the Testing and Balancing Contractor directly contracted by the General Contractor and independent of the Sheet Metal Contractor.
- B. Ductwork leakage testing shall be performed for the entire air distribution system (including all supply, return, exhaust and relief ductwork), section by section, including fans, coils and filter sections. Based upon satisfactory initial duct leakage test results, the scope of the testing may be reduced by the Resident Engineer on ductwork constructed to the 500 Pa (2" WG) duct pressure classification. In no case shall the leakage testing of ductwork constructed above the 500 Pa (2" WG) duct pressure classification or ductwork located in shafts or other inaccessible areas be eliminated.

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- C. Test procedure, apparatus and report shall conform to SMACNA Leakage Test manual. The maximum leakage rate allowed is 4 percent of the design air flow rate.
- D. All ductwork shall be leak tested first before enclosed in a shaft or covered in other inaccessible areas.
- E. All tests shall be performed in the presence of the Resident Engineer and the Test and Balance agency. The Test and Balance agency shall measure and record duct leakage and report to the Resident Engineer and identify leakage source with excessive leakage.
- F. If any portion of the duct system tested fails to meet the permissible leakage level, the Contractor shall rectify sealing of ductwork to bring it into compliance and shall retest it until acceptable leakage is demonstrated to the Resident Engineer.
- G. All tests and necessary repairs shall be completed prior to insulation or concealment of ductwork.
- H. Make sure all openings used for testing flow and temperatures by TAB Contractor are sealed properly.

**3.3 TESTING, ADJUSTING AND BALANCING (TAB)**

Refer to Section 23 05 93, TESTING, ADJUSTING, and BALANCING FOR HVAC.

**3.4 OPERATING AND PERFORMANCE TESTS**

Refer to Section 23 05 11, COMMON WORK RESULTS FOR HVAC and STEAM GENERATION

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SECTION 23 34 00  
HVAC FANS

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Fans for heating, ventilating and air conditioning.
- B. Product Definitions: AMCA Publication 99, Standard 1-66.

1.2 RELATED WORK

- A. Section 01 00 00, GENERAL REQUIREMENTS.
- B. Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- C. Section 13 05 41, SEISMIC RESTRAINT REQUIREMENTS FOR NON-STRUCTURAL COMPONENTS.
- D. Section 23 05 11, COMMON WORK RESULTS FOR HVAC AND STEAM GENERATION.
- E. Section 23 05 12, GENERAL MOTOR REQUIREMENTS FOR HVAC AND STEAM GENERATION EQUIPMENT.
- F. Section 23 05 41, NOISE AND VIBRATION CONTROL FOR HVAC PIPING AND EQUIPMENT.
- G. Section 23 05 93, TESTING, ADJUSTING, AND BALANCING FOR HVAC.
- H. Section 23 09 23, DIRECT-DIGITAL CONTROL SYSTEM FOR HVAC.
- I. Section 23 73 00, INDOOR CENTRAL-STATION AIR-HANDLING UNITS.
- J. Section 23 82 16, AIR COILS.
- K. Section 26 29 11, LOW-VOLTAGE MOTOR STARTERS.

1.3 QUALITY ASSURANCE

- A. Refer to paragraph, QUALITY ASSURANCE, in Section 23 05 11, COMMON WORK RESULTS FOR HVAC AND STEAM GENERATION.
- B. Fans and power ventilators shall be listed in the current edition of AMCA 261, and shall bear the AMCA performance seal.
- C. Operating Limits for Centrifugal Fans: AMCA 99 (Class I, II, and III).
- D. Fans and power ventilators shall comply with the following standards:
  - 1. Testing and Rating: AMCA 210.
  - 2. Sound Rating: AMCA 300.
- E. Vibration Tolerance for Fans and Power Ventilators: Section 23 05 41, NOISE AND VIBRATION CONTROL FOR HVAC PIPING AND EQUIPMENT.
- F. Performance Criteria:
  - 1. The fan schedule shall show the design air volume and static pressure. Select the fan motor HP by increasing the fan BHP by 10 percent to account for the drive losses and field conditions.
  - 2. Select the fan operating point as follows:
    - a. Air Foil, Backward Inclined, or Tubular: At or near the peak static efficiency Note: Provide fan with stable operation at both scheduled "future" CFM, and at scheduled "current" CFM.

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- G. Safety Criteria: Provide manufacturer's standard screen on fan inlet and discharge where exposed to operating and maintenance personnel.
- H. Corrosion Protection:
  - 1. Except for fans in fume hood exhaust service, all steel shall be mill-galvanized, or phosphatized and coated with minimum two coats, corrosion resistant enamel paint. Manufacturers paint and paint system shall meet the minimum specifications of: ASTM D1735 water fog; ASTM B117 salt spray; ASTM D3359 adhesion; and ASTM G152 and G153 for carbon arc light apparatus for exposure of non-metallic material.

**1.4 SUBMITTALS**

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, and SAMPLES.
- B. Manufacturers Literature and Data:
  - 1. Fan sections, motors and drives.
  - 2. Centrifugal fans, motors, drives, accessories and coatings.
    - a. In-line centrifugal fans.
    - b. Tubular Centrifugal Fans.
- C. Certified Sound power levels for each fan.
- D. Motor ratings types, electrical characteristics and accessories.
- E. Belt guards.
- F. Maintenance and Operating manuals in accordance with Section 01 00 00, GENERAL REQUIREMENTS.
- G. Certified fan performance curves for each fan showing cubic feet per minute (CFM) versus static pressure, efficiency, and horsepower for design point of operation, for both future and current scheduled flow rates.

**1.5 APPLICABLE PUBLICATIONS**

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.
- B. Air Movement and Control Association International, Inc. (AMCA):
  - 99-86 .....Standards Handbook
  - 210-06 .....Laboratory Methods of Testing Fans for  
Aerodynamic Performance Rating
  - 261-09 .....Directory of Products Licensed to bear the AMCA  
Certified Ratings Seal - Published Annually
  - 300-08 .....Reverberant Room Method for Sound Testing of  
Fans
- C. American Society for Testing and Materials (ASTM):



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- B117-07a .....Standard Practice for Operating Salt Spray (Fog) Apparatus
- D1735-08 .....Standard Practice for Testing Water Resistance of Coatings Using Water Fog Apparatus
- D3359-08 .....Standard Test Methods for Measuring Adhesion by Tape Test
- G152-06 .....Standard Practice for Operating Open Flame Carbon Arc Light Apparatus for Exposure of Non-Metallic Materials
- G153-04 .....Standard Practice for Operating Enclosed Carbon Arc Light Apparatus for Exposure of Non-Metallic Materials
- D. National Fire Protection Association (NFPA):
  - NFPA 96-08 .....Standard for Ventilation Control and Fire Protection of Commercial Cooking Operations
- E. National Sanitation Foundation (NSF):
  - 37-07 .....Air Curtains for Entrance Ways in Food and Food Service Establishments
- F. Underwriters Laboratories, Inc. (UL):
  - 181-2005 .....Factory Made Air Ducts and Air Connectors

**1.6 EXTRA MATERIALS**

- A. Provide one additional set of belts for all belt-driven fans.

**PART 2 - PRODUCTS**

**2.1 FAN SECTION (CABINET FAN)**

Refer to specification Section 23 73 00, INDOOR CENTRAL-STATION AIR-HANDLING UNITS.

**2.2 CENTRIFUGAL FANS**

- A. Standards and Performance Criteria: Refer to Paragraph, QUALITY ASSURANCE. Record factory vibration test results on the fan or furnish to the Contractor.
- B. Construction: Wheel diameters and outlet areas shall be in accordance with AMCA standards.
  - 1. Housing: Low carbon steel, arc welded throughout, braced and supported by structural channel or angle iron to prevent vibration or pulsation, flanged outlet, inlet fully streamlined. Provide lifting clips, and casing drain. Provide manufacturer's standard access door. Provide 12.5 mm (1/2 inches) wire mesh screens for fan inlets without duct connections.

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2. Wheel: Steel plate with die formed blades welded or riveted in place, factory balanced statically and dynamically.
3. Shaft: Designed to operate at no more than 70 percent of the first critical speed at the top of the speed range of the fans class.
4. Bearings: Heavy duty ball or roller type sized to produce a B10 life of not less than 50,000 hours, and an average fatigue life of 200,000 hours. Extend filled lubrication tubes for interior bearings or ducted units to outside of housing.
5. Belts: Oil resistant, non-sparking and non-static.
6. Belt Drives: Factory installed with final alignment belt adjustment made after installation.
7. Motors and Fan Wheel Pulleys: Adjustable pitch for use with motors through 15HP, fixed pitch for use with motors larger than 15HP. Select pulleys so that pitch adjustment is at the middle of the adjustment range at fan design conditions.
8. Motor, adjustable motor base, drive and guard: Furnish from factory with fan. Refer to Section 23 05 11, COMMON WORK RESULTS FOR HVAC AND STEAM GENERATION for specifications. Provide protective sheet metal enclosure for fans located outdoors.
9. Furnish variable speed fan motor controllers where shown on the drawings. Refer to Section, MOTOR STARTERS. Refer to Section 23 05 11, COMMON WORK RESULTS FOR HVAC AND STEAM GENERATION for controller/motor combination requirements.
- C. In-line Centrifugal Fans: In addition to the requirements of paragraphs A and 2.2.C3 thru 2.2.C9, provide minimum 18 Gauge galvanized steel housing with inlet and outlet flanges, backward inclined aluminum centrifugal fan wheel, bolted access door and supports as required. Motors shall be factory pre-wired to an external junction box. Provide factory wired disconnect switch.

**PART 3 - EXECUTION**

**3.1 INSTALLATION**

- A. Install fan, motor and drive in accordance with manufacturer's instructions.
- B. Align fan and motor sheaves to allow belts to run true and straight.
- C. Install vibration control devices as shown on drawings and specified in Section 23 05 41, NOISE AND VIBRATION CONTROL FOR HVAC PIPING AND EQUIPMENT.

**3.2 PRE-OPERATION MAINTENANCE**

- A. Lubricate bearings, pulleys, belts and other moving parts with manufacturer recommended lubricants.

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- B. Rotate impeller by hand and check for shifting during shipment and check all bolts, collars, and other parts for tightness.
- C. Clean fan interiors to remove foreign material and construction dirt and dust.

**3.3 START-UP AND INSTRUCTIONS**

- A. Verify operation of motor, drive system and fan wheel according to the drawings and specifications.
- B. Check vibration and correct as necessary for air balance work.
- C. After air balancing is complete and permanent sheaves are in place perform necessary field mechanical balancing to meet vibration tolerance in Section 23 05 41, NOISE AND VIBRATION CONTROL FOR HVAC PIPING AND EQUIPMENT.

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SECTION 23 36 00  
AIR TERMINAL UNITS

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

Air terminal units, air flow control valves.

**1.2 RELATED WORK**

- A. Section 13 05 41, SEISMIC RESTRAINT REQUIREMENTS FOR NON-STRUCTURAL COMPONENTS: Seismic restraints for equipment.
- B. Section 23 05 11, COMMON WORK RESULTS FOR HVAC AND STEAM GENERATION: General mechanical requirements and items, which are common to more than one section of Division 23.
- C. Section 23 05 41, NOISE AND VIBRATION CONTROL FOR HVAC PIPING AND EQUIPMENT: Noise requirements.
- D. Section 23 31 00, HVAC DUCTS AND CASINGS: Ducts and flexible connectors.
- E. Section 23 09 23, DIRECT-DIGITAL CONTROL SYSTEM FOR HVAC: Valve operators.
- F. Section 23 05 93, TESTING, ADJUSTING, AND BALANCING FOR HVAC: Flow rates adjusting and balancing.
- G. Section 23 82 16, AIR COILS: Heating and Cooling Coils pressure ratings.

**1.3 QUALITY ASSURANCE**

Refer to Paragraph, QUALITY ASSURANCE, in Section 23 05 11, COMMON WORK RESULTS FOR HVAC AND STEAM GENERATION.

**1.4 SUBMITTALS**

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, and SAMPLES.
- B. Manufacturer's Literature and Data:
  - 1. Air Terminal Units: Submit test data.
  - 2. Air flow control valves.
- C. Certificates:
  - 1. Compliance with paragraph, QUALITY ASSURANCE.
  - 2. Compliance with specified standards.
- D. Operation and Maintenance Manuals: Submit in accordance with paragraph, INSTRUCTIONS, in Section 01 00 00, GENERAL REQUIREMENTS.

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**1.5 APPLICABLE PUBLICATIONS**

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.
- B. Air Conditioning and Refrigeration Institute (AHRI)/(ARI):  
880-08 .....Air Terminals Addendum to ARI 888-98  
incorporated into standard posted 15<sup>th</sup> December  
2002
- C. National Fire Protection Association (NFPA):  
90A-09 .....Standard for the Installation of Air  
Conditioning and Ventilating Systems
- D. Underwriters Laboratories, Inc. (UL):  
181-08 .....Standard for Factory-Made Air Ducts and Air  
Connectors
- E. American Society for Testing and Materials (ASTM):  
C 665-06 .....Standard Specification for Mineral-Fiber  
Blanket Thermal Insulation for Light Frame  
Construction and Manufactured Housing

**1.6 GUARANTY**

In accordance with the GENERAL CONDITIONS

**PART 2 - PRODUCTS**

**2.1 GENERAL**

- A. Coils:
  - 1. All Air-Handling Units: Provide aluminum fins and copper coils for all hot water reheat coils.
  - 2. Water Heating Coils:
    - a. ARI certified, continuous plate or spiral fin type, leak tested at 2070 kPa (300 PSI).
    - b. Capacity: As indicated, based on scheduled entering water temperature.
    - c. Headers: Copper or Brass.
    - d. Fins: Aluminum, maximum 315 fins per meter (8 fins per inch).
    - e. Tubes: Copper, arrange for counter-flow of heating water.
    - f. Water Flow Rate: Minimum 0.032 Liters/second (0.5 GPM).
    - g. Provide vent and drain connection at high and low point, respectively of each coil.
    - h. Coils shall be guaranteed to drain.

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- B. Labeling: Control box shall be clearly marked with an identification label that lists such information as nominal CFM, maximum and minimum factory-set airflow limits, coil type and coil connection orientation, where applicable.
- C. Factory calibrate air terminal units to air flow rate indicated. All settings including maximum and minimum air flow shall be field adjustable.
- D. Dampers with internal air volume control: See section 23 31 00 HVAC DUCTS and CASINGS.
- E. Terminal Sound Attenuators: See Section 23 31 00 (HVAC DUCTS AND CASINGS).

**2.2 AIR TERMINAL UNITS (BOXES)**

- A. General: Factory built, pressure independent units, factory set-field adjustable air flow rate, suitable for single duct applications. Use of dual-duct air terminal units is not permitted. Clearly show on each unit the unit number and factory set air volumes corresponding to the contract drawings. Section 23 05 93, TESTING, ADJUSTING, AND BALANCING FOR HVAC work assumes factory set air volumes. Coordinate flow controller sequence and damper operation details with the drawings and Section 23 09 23, DIRECT-DIGITAL CONTROL SYSTEM FOR HVAC. All air terminal units shall be brand new products of the same manufacturer.
- B. Capacity and Performance: The Maximum Capacity of a single terminal unit shall not exceed 566 Liters/second (1,200 CFM).
- C. Sound Power Levels:

Acoustic performance of the air terminal units shall be based on the design noise levels for the spaces stipulated in Section 23 05 41 (Noise and Vibration Control for HVAC Piping and Equipment). Equipment schedule (...) shall show the sound power levels in all octave bands. Terminal sound attenuators shall be provided, as required, to meet the intent of the design.
- D. Casing: Unit casing shall be constructed of galvanized steel no lighter than 0.85 mm (22 Gauge). Provide hanger brackets for attachment of supports.
  - 1. Lining material: Suitable to provide required acoustic performance, thermal insulation and prevent sweating. Meet the requirements of NFPA 90A and comply with UL 181 for erosion as well as ASTM C 665 antimicrobial requirements. Insulation shall consist of 13 mm (1/2

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- IN) thick non-porous foil faced rigid fiberglass insulation of 4-lb/cu.ft, secured by full length galvanized steel z-strips which enclose and seal all edges. Tape and adhesives shall not be used. Materials shall be non-friable and with surfaces, including all edges, fully encapsulated and faced with perforated metal or coated so that the air stream will not detach material. No lining material is permitted in the boxes serving operating rooms and Cystoscopy rooms.
2. Access panels (or doors): Provide panels large enough for inspection, adjustment and maintenance without disconnecting ducts, and for cleaning heating coils attached to unit, even if there are no moving parts. Panels shall be insulated to same standards as the rest of the casing and shall be secured and gasketed airtight. It shall require no tool other than a screwdriver to remove.
  3. Total leakage from casing: Not to exceed 2 percent of the nominal capacity of the unit when subjected to a static pressure of 750 Pa (3 inch WG), with all outlets sealed shut and inlets fully open.
  4. Octopus connector: Factory installed, lined air distribution terminal. Provide where flexible duct connections are shown on the drawings connected directly to terminals. Provide butterfly-balancing damper, with locking means in connectors with more than one outlet. Octopus connectors and flexible connectors are not permitted in the Surgical Suite.
- E. Construct dampers and other internal devices of corrosion resisting materials which do not require lubrication or other periodic maintenance.
1. Damper Leakage: Not greater than 2 percent of maximum rated capacity, when closed against inlet static pressure of 1 kPa (4 inch WG).
- F. Provide multi-point velocity pressure sensors with external pressure taps.
1. Provide direct reading air flow rate table pasted to box.
- G. Provide static pressure tubes.
- H. Externally powered DDC variable air volume controller and damper actuator to be furnished under Section 23 09 23, DIRECT-DIGITAL CONTROL SYSTEM FOR HVAC for factory mounting on air terminal units. The DDC controller shall be electrically actuated.



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**2.3 AIR FLOW CONTROL VALVE (AFCV)**

- A. Airflow control device shall be a venturi valve type air flow control valve.
- B. Pressure independent over a 150 Pa-750 Pa (0.6 inch WG - 3.0 inch WG) drop across valve.
- C. Volume control accurate to plus or minus 5% of airflow over an airflow turndown range of 16 to 1. No minimum entrance or exit duct diameters shall be required to ensure accuracy or pressure independence.
- D. Response time to change in command signal and duct static pressure within three seconds.
- E. 16 gauge spun aluminum valve body and control device with continuous welded seam and 316 stainless steel shaft and shaft support brackets. Pressure independent springs shall be stainless steel. Shaft bearing surfaces shall be Teflon or polyester.
- F. The airflow device shall have no exposed aluminum or stainless steel components. The shaft support brackets, pivot arm, internal mounting link, and pressure independent springs shall have a baked-on corrosion resistant phenolic coating. Internal nuts, bolts, and rivets shall be titanium or phenolic coated stainless steel.
- G. Constant volume units:
  - 1. Actuator to be factory mounted to the valve.
  - 2. Closed loop control of airflow by way of flow feedback signal with less than 1 second response time.
  - 3. Shaft positioned using direct potentiometer measurement to produce a linear factory calibrated feedback.
  - 4. The maximum and minimum airflows shall be as scheduled.
- H. Variable volume units:
  - 1. Actuator to be factory mounted to the valve.
  - 2. Closed loop control of airflow by way of flow feedback signal with less than 1 second response time.
  - 3. Shaft positioned using direct potentiometer measurement to produce a linear factory calibrated feedback.
- I. Certification:
  - 1. Control device: factory calibrated to airflows detailed on plans using NIST traceable air stations and instrumentation having a

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- combined accuracy of plus or minus 1% of signal over the entire range of measurement.
2. Electronic airflow control devices: further calibrated and their accuracy verified to plus or minus 5% of signal at a minimum of eight different airflows across the full operating range of the device.
  3. All airflow control devices: individually marked with device specific, factory calibration data to include: tag number, serial number, model number, eight point characterization information (for electronic devices), and quality control inspection numbers.
- J. Airflow measuring devices and airflow control devices that are not venturi valves (e.g., Pitot tube, flow cross, air bar, orifice ring, vortex shedder, etc.) are acceptable, provided the following conditions are met:
1. They meet the performance and construction characteristics stated throughout this section of the specification.
  2. Suppliers of airflow control devices or airflow measuring devices requiring minimum duct diameters: provide revised duct layouts showing the required straight duct runs upstream and downstream of these devices.
  3. Supplier of the airflow control system: submit coordination drawings reflecting these changes and include static pressure loss calculations as part of submittal.

**PART 3 - EXECUTION**

**3.1 INSTALLATION**

- A. Work shall be installed as shown and according to the manufacturer's diagrams and recommendations.
- B. Handle and install units in accordance with manufacturer's written instructions.
- C. Support units rigidly so they remain stationary at all times. Cross-bracing or other means of stiffening shall be provided as necessary. Method of support shall be such that distortion and malfunction of units cannot occur.
- D. Locate air terminal units to provide a straight section of inlet duct for proper functioning of volume controls. See VA Standard Detail.

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### 3.2 OPERATIONAL TEST

Refer to Section 23 05 11, COMMON WORK RESULTS FOR HVAC AND STEAM  
GENERATION.

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SECTION 23 37 00  
AIR OUTLETS AND INLETS

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

- A. Air Outlets and Inlets: Diffusers, Registers, and Grilles.

**1.2 RELATED WORK**

- A. Outdoor and Exhaust Louvers: Section 08 90 00, LOUVERS AND VENTS.  
B. Seismic Reinforcing: Section 13 05 41, SEISMIC RESTRAINT REQUIREMENTS FOR NON-STRUCTURAL COMPONENTS.  
C. General Mechanical Requirements: Section 23 05 11, COMMON WORK RESULTS FOR HVAC AND STEAM GENERATION.  
D. Noise Level Requirements: Section 23 05 41, NOISE AND VIBRATION CONTROL FOR HVAC PIPING AND EQUIPMENT.  
E. Testing and Balancing of Air Flows: Section 23 05 93, TESTING, ADJUSTING, AND BALANCING FOR HVAC.

**1.3 QUALITY ASSURANCE**

- A. Refer to article, QUALITY ASSURANCE, in Section 23 05 11, COMMON WORK RESULTS FOR HVAC AND STEAM GENERATION.  
B. Fire Safety Code: Comply with NFPA 90A.

**1.4 SUBMITTALS**

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, and SAMPLES.  
B. Manufacturer's Literature and Data:  
1. Air intake/exhaust hoods.  
2. Diffusers, registers, grilles and accessories.  
C. Coordination Drawings: Refer to article, SUBMITTALS, in Section 23 05 11, COMMON WORK RESULTS FOR HVAC AND STEAM GENERATION.

**1.5 APPLICABLE PUBLICATIONS**

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.  
B. Air Diffusion Council Test Code:  
1062 GRD-84 .....Certification, Rating, and Test Manual 4<sup>th</sup>  
Edition  
C. American Society of Civil Engineers (ASCE):  
ASCE7-05 .....Minimum Design Loads for Buildings and Other  
Structures

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- D. American Society for Testing and Materials (ASTM):  
A167-99 (2004) .....Standard Specification for Stainless and  
Heat-Resisting Chromium-Nickel Steel Plate,  
Sheet and Strip  
B209-07 .....Standard Specification for Aluminum and  
Aluminum-Alloy Sheet and Plate
- E. National Fire Protection Association (NFPA):  
90A-09 .....Standard for the Installation of Air  
Conditioning and Ventilating Systems
- F. Underwriters Laboratories, Inc. (UL):  
181-08 .....UL Standard for Safety Factory-Made Air Ducts  
and Connectors

**PART 2 - PRODUCTS**

**2.1 EQUIPMENT SUPPORTS**

Refer to Section 21 05 11, COMMON WORK RESULTS FOR FIRE SUPPRESSION,  
Section 22 05 11, COMMON WORK RESULTS FOR PLUMBING, and Section 23 05 11,  
COMMON WORK RESULTS FOR HVAC AND STEAM GENERATION.

**2.2 AIR OUTLETS AND INLETS**

- A. Materials:
1. Steel or aluminum. Use aluminum air outlets and inlets for facilities located in high-humidity areas. Exhaust air registers located in combination toilets and shower stalls shall be constructed from aluminum. Provide manufacturer's standard gasket.
  2. Exposed Fastenings: The same material as the respective inlet or outlet. Fasteners for aluminum may be stainless steel.
  3. Contractor shall review all ceiling drawings and details and provide all ceiling mounted devices with appropriate dimensions and trim for the specific locations.
- B. Performance Test Data: In accordance with Air Diffusion Council Code 1062GRD. Refer to Section 23 05 41, NOISE AND VIBRATION CONTROL FOR HVAC PIPING AND EQUIPMENT for NC criteria.
- C. Air Supply Outlets:
1. Ceiling Diffusers: Suitable for surface mounting, exposed T-bar or special tile ceilings, off-white finish, square or round neck connection as shown on the drawings. Provide plaster frame for units in plaster ceilings.
    - a. Square, plaque, fully adjustable pattern: Round neck, surface mounting unless shown otherwise on the drawings. Provide equalizing or control grid and volume control damper.

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- b. Plaque face type: Square or rectangular, removable core for 1, 2, 3, or 4 way directional pattern. Provide equalizing or control grid and opposed blade damper.
- c. Perforated face type: Manual adjustment for one-, two-, three-, or four-way horizontal air distribution pattern without change of air volume or pressure. Provide equalizing or control grid and opposed blade over overlapping blade damper. Perforated face diffusers for VAV systems shall have the pattern controller on the inner face, rather than in the neck and designed to discharge air horizontally at the ceiling maintaining a Coanda effect.
- d. Slot diffuser/plenum:
  - 1) Diffuser: Frame and support bars shall be constructed of heavy gauge extruded aluminum. Form slots or use adjustable pattern controllers, to provide stable, horizontal air flow pattern over a wide range of operating conditions.
  - 2) Galvanized steel boot lined with 13 mm (1/2 inch) thick fiberglass conforming to NFPA 90A and complying with UL 181 for erosion. The internal lining shall be factory-fabricated, anti-microbial, and non-friable.
  - 3) Provide inlet connection diameter equal to duct diameter shown on drawings or provide transition coupling if necessary. Inlet duct and plenum size shall be as recommended by the manufacturer.
  - 4) Maximum pressure drop at design flow rate: 37 Pa (0.15 inch W.G.)
- 2. Linear Bar Grilles and Diffusers: Extruded aluminum, manufacturer's standard finish, and positive holding concealed fasteners.
  - a. Margin Frame: Flat, 20 mm (3/4 inch) wide.
  - b. Bars: Minimum 5 mm (3/16 inch) wide by 20 mm (3/4 inch) deep, zero deflection unless otherwise shown. Bar spacing shall be a minimum of 3 mm (1/8 inch) on center. Reinforce bars on 450 mm (18 inch) center for sidewall units and on 150 mm (6 inch) center for units installed in floor or sills.
  - c. Provide opposed blade damper and equalizing or control grid where shown.
- 4. Supply Registers: Double deflection type with horizontal face bars and opposed blade damper with removable key operator.
  - a. Margin: Flat, 30 mm (1-1/4 inches) wide.
  - b. Bar spacing: 20 mm (3/4 inch) maximum.

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- c. Finish: Off white baked enamel for ceiling mounted units. Wall units shall have a prime coat for field painting, or shall be extruded with manufacturer's standard finish.
- 5. Supply Grilles: Same as registers but without the opposed blade damper.
- D. Return and Exhaust Registers and Grilles: Provide opposed blade damper without removable key operator for registers.
  - 1. Finish: Off-white baked enamel for ceiling mounted units. Wall units shall have a prime coat for field painting, or shall be extruded aluminum with manufacturer's standard aluminum finish.
  - 2. Plaque Type: Fixed horizontal face bars set at 30 to 45 degrees, approximately 30 mm (1-1/4 inch) margin.
  - 3. Plaque Face Type: To match supply units.
  - 4. Linear Type: To match supply units.
  - 5. Door Grilles: Are furnished with the doors.
- E. Supply Registers in Psychiatric Rooms: Supply air registers shall be security type, steel with perforated faceplate, flat surface margin, extension sleeve, opposed blade damper and back mounting flanges. Faceplate shall be 5 mm (3/16 inch) (minimum) with 5x5 mm holes on 7 mm (3/16 by 3/16 inch holes on 9/32 inch) spacing and a minimum free area of 45 percent. Wall sleeve shall be 5 mm (3/16 inch) thick (minimum).
- F. Air Inlet Registers in Psychiatric Rooms: Return, exhaust, transfer and relief air registers shall be security type, steel with perforated faceplate, flat surface margin, wall sleeve, opposed blade damper and back mounting flanges. Faceplate shall be 5 mm (3/16 inch) (minimum) with 5x5 mm holes on 7 mm (3/16 by 3/16 inch holes on 9/32 inch) spacing and a minimum free area of 45 percent. Wall sleeve shall be 5 mm (3/16 inch) thick (minimum).
- G. Acoustic Transfer Grille: Aluminum, suitable for partition or wall mounting.

**2.4 WIRE MESH GRILLE**

- A. Fabricate grille with 2 x 2 mesh 13 mm (1/2 inch) galvanized steel or aluminum hardware cloth in a spot welded galvanized steel frame with approximately 40 mm (1-1/2 inch) margin.
- B. Use grilles where shown in unfinished areas such as mechanical rooms.



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**PART 3 - EXECUTION**

**3.1 INSTALLATION**

- A. Comply with provisions of Section 23 05 11, COMMON WORK RESULTS FOR HVAC AND STEAM GENERATION, particularly regarding coordination with other trades and work in existing buildings.
- B. Protection and Cleaning: Protect equipment and materials against physical damage. Place equipment in first class operating condition, or return to source of supply for repair or replacement, as determined by Resident Engineer. Protect equipment during construction against entry of foreign matter to the inside and clean both inside and outside before operation and painting.

**3.2 TESTING, ADJUSTING AND BALANCING (TAB)**

Refer to Section 23 05 93, TESTING, ADJUSTING, AND BALANCING FOR HVAC.

**3.3 OPERATING AND PERFORMANCE TESTS**

Refer to Section 23 05 11, COMMON WORK RESULTS FOR HVAC AND STEAM GENERATION

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SECTION 23 40 00  
HVAC AIR CLEANING DEVICES

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Air filters for heating, ventilating and air conditioning.
- B. Definitions: Refer to ASHRAE Standard 52.2 for definitions of face velocity, net effective filtering area, media velocity, initial resistance (pressure drop), MERV (Minimum Efficiency Reporting Value), PSE (Particle Size Efficiency), particle size ranges for each MERV number, dust holding capacity and explanation of electrostatic media based filtration products versus mechanical filtration products. Refer to ASHRAE Standard 52.2 Appendix J for definition of MERV-A.

1.2 RELATED WORK

- A. Section 23 05 11, COMMON WORK RESULTS FOR HVAC AND STEAM GENERATION: General mechanical requirements and items, which are common to more than one section of Division 23.
- B. Section 23 73 00, INDOOR CENTRAL-STATION AIR-HANDLING UNITS: Filter housing and racks.

1.3 QUALITY ASSURANCE

- A. Air Filter Performance Report for Extended Surface Filters:
  - 1. Submit a test report for each Grade of filter being offered. The report shall not be more than three (3) years old and prepared by using test equipment, method and duct section as specified by ASHRAE Standard 52.2 for type filter under test and acceptable to Resident Engineer, indicating that filters comply with the requirements of this specification. Filters utilizing partial or complete synthetic media will be tested in compliance with pre-conditioning steps as stated in Appendix J. All testing is to be conducted on filters with a nominal 24 inch by 24 inch face dimension. Test for 150 m/min (500 fpm) will be accepted for lower velocity rated filters provided the test report of an independent testing laboratory complies with all the requirements of this specification.
  - 2. Guarantee Performance: The manufacturer shall supply ASHRAE 52.2 test reports on each filter type submitted. Any filter supplied will be required to maintain the minimum efficiency shown on the ASHRAE Standard 52.2 report throughout the time the filter is in service. Within the first 6-12 weeks of service a filter may be pulled out of service and sent to an independent laboratory for ASHRAE Standard

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52.2 testing for initial efficiency only. If this filter fails to meet the minimum level of efficiency shown in the previously submitted reports, the filter manufacturer/distributor shall take back all filters and refund the owner all monies paid for the filters, cost of installation, cost of freight and cost of testing.

- B. Filter Warranty for Extended Surface Filters: Guarantee the filters against leakage, blow-outs, and other deficiencies during their normal useful life, up to the time that the filter reaches the final pressure drop. Defective filters shall be replaced at no cost to the Government.
- C. Comply with UL Standard 900 for flame test.
- D. Nameplates: Each filter shall bear a label or name plate indicating manufacturer's name, filter size, rated efficiency, // UL classification, and file number.

**1.4 SUBMITTALS**

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Manufacturer's Literature and Data:
  - 1. Extended surface filters.
  - 2. Holding frames. Identify locations.
  - 3. Side access housings. Identify locations, verify insulated doors.
  - 4. HEPA filters.
  - 5. Magnehelic gages.
- C. Air Filter performance reports.
- D. Suppliers warranty.
- E. Field test results for HEPA filters as per paragraph 2.3.E.3.

**1.5 APPLICABLE PUBLICATIONS**

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by basic designation only.
- B. American Society of Heating, Refrigerating and Air-conditioning Engineers, Inc. (ASHRAE):
  - 52.2-2007.....Method of Testing General Ventilation Air-Cleaning Devices for Removal Efficiency by Particle Size, including Appendix J
- C. American Society of Mechanical Engineers (ASME):
  - NQA-1-2008 .....Quality Assurance Requirements for Nuclear Facilities Applications
- D. Underwriters Laboratories, Inc. (UL):
  - 900;Revision 15 July 2009      Test Performance of Air Filter Units

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**PART 2 - PRODUCTS**

**2.1 REPLACEMENT FILTER ELEMENTS TO BE FURNISHED**

- A. To allow temporary use of HVAC systems for testing and in accordance with Paragraph, TEMPORARY USE OF MECHANICAL AND ELECTRICAL SYSTEMS in Section 01 00 00, GENERAL REQUIREMENTS, provide one complete set of additional filters to the Resident Engineer.
- B. The Resident Engineer will direct whether these additional filters will either be installed as replacements for dirty units or turned over to VA for future use as replacements.

**2.2 EXTENDED SURFACE AIR FILTERS**

- A. Use factory assembled air filters of the extended surface type with supported or non-supported cartridges for removal of particulate matter in air conditioning, heating and ventilating systems. Filter units shall be of the extended surface type fabricated for disposal when the contaminant load limit is reached as indicated by maximum (final) pressure drop.
- B. Filter Classification: UL listed and approved conforming to UL Standard 900.
- C. HVAC Filter Types

HVAC Filter Types Table 2.2C				
MERV Value ASHRAE 52.2	MERV-A Value ASHRAE 62.2 Appendix J	Application	Particle Size	Thickness /Type
8	8-A	Pre-Filter	3 to 10 Microns	50 mm (2-inch) Throwaway
11	11-A	After-Filter	1 to 3 Microns	150 mm (6-inch) or 300 mm (12-inch) Rigid Cartridge
13	13-A	After-Filter	0.3 to 1 Microns	150 mm (6-inch) or 300 mm (12-inch) Rigid Cartridge
14	14-A	After-Filter	0.3 to 1 Microns	150 mm (6-inch) or 300 mm (12-inch) Rigid Cartridge

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**2.3 MEDIUM EFFICIENCY PLEATED PANEL PRE-FILTERS (2"; MERV 8; UL 900 CLASS 2):**

- A. Construction: Air filters shall be medium efficiency ASHRAE pleated panels consisting of cotton and synthetic or 100% virgin synthetic media, self supporting media with required media stabilizers, and beverage board enclosing frame. Filter media shall be lofted to a uniform depth and formed into a uniform radial pleat. The media stabilizers shall be bonded to the downstream side of the media to maintain radial pleats and prevent media oscillation. An enclosing frame of no less than 28-point high wet-strength beverage board shall provide a rigid and durable enclosure. The frame shall be bonded to the media on all sides to prevent air bypass. Integral diagonal support members on the air entering and air exiting side shall be bonded to the apex of each pleat to maintain uniform pleat spacing in varying airflows.
- B. Performance: The filter shall have a Minimum Efficiency Reporting Value of MERV 8 when evaluated under the guidelines of ASHRAE Standard 52.2. It shall also have a MERV-A of 8 when tested per Appendix J of the same standard. The media shall maintain or increase in efficiency over the life of the filter. Pertinent tolerances specified in Section 7.4 of the Air-Conditioning and Refrigeration Institute (ARI) Standard 850-93 shall apply to the performance ratings. All testing is to be conducted on filters with a nominal 24" x 24" face dimension.

Minimum Efficiency Reporting (MERV)	8
Dust Holding Capacity (Grams)	105
Nominal Size (Width x Height x Depth)	24x24x2
Rated Air Flow Capacity (Cubic Feet per Minute)	2,000
Rated Air Flow Rate (Feet per Minute)	500
Final Resistance (Inches w.g.)	1.0
Maximum Recommended Change-Out Resistance (Inches w.g.)	0.66
Rated Initial Resistance (Inches w.g.)	0.33

- C. The filters shall be approved and listed by Underwriters' Laboratories, Inc. as Class 2 when tested according to U. L. Standard 900 and CAN 4-5111.

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**2.4 HIGH EFFICIENCY EXTENDED SURFACE (INTERMEDIATE/AFTER (FINAL)) CARTRIDGE  
FILTERS (12"; MERV 14/13/11; UL 900 CLASS 2):**

- A. Construction: Air filters shall consist of 8 pleated media packs assembled into 4 V-banks within a totally plastic frame. The filters shall be capable of operating at temperatures up to 80 degrees C (176 degrees F). The filters must either fit without modification or be adaptable to the existing holding frames. The molded end panels are to be made of high impact polystyrene plastic. The center support members shall be made of ABS plastic. No metal components are to be used.
- B. Media: The media shall be made of micro glass fibers with a water repellent binder. The media shall be a dual density construction, with coarser fibers on the air entering side and finer fibers on the air leaving side. The media shall be pleated using separators made of continuous beads of low profile thermoplastic material. The media packs shall be bonded to the structural support members at all points of contact, this improves the rigidity as well as eliminates potential air bypass in the filter
- C. Performance: Filters of the size, air flow capacity and nominal efficiency (MERV) shall meet the following rated performance specifications based on the ASHRAE 52.2-1999 test method. Where applicable, performance tolerance specified in Section 7.4 of the Air-Conditioning and Refrigeration Institute (ARI) Standard 850-93 shall apply to the performance ratings. All testing is to be conducted on filters with a nominal 24"x24" header dimension.

Minimum Efficiency Reporting Value (MERV)	14	13	11
Gross Media Area (Sq. Ft.)	197	197	197
Dust Holding Capacity (Grams)	486	430	465
Nominal Size (Width x Height x Depth)	24x24x12	24x24x12	24x24x12
Rated Air Flow Capacity (cubic feet per minute)	2,000	2,000	2,000
Rated Air Flow Rate (feet per minute)	500	500	500
Final Resistance (inches w.g.)	2.0	2.0	2.0
Maximum Recommended Change-Out Resistance (Inches w.g.)	0.74	0.68	0.54

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Rated Initial Resistance (inches w.g.)	0.37	0.34	0.27
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**2.5 INSTRUMENTATION**

- A. Magnehelic Differential Pressure Filter Gages: Nominal 100 mm (four inch) diameter, zero to 500 Pa (zero to two inch water gage), three inch for HEPA) range, //except for MERV 17 HEPA Final Filters, where the range shall be zero to 750 Pa (zero to three inch water gage)// Gauges shall be flush-mounted in aluminum panel board, complete with static tips, copper or aluminum tubing, and accessory items to provide zero adjustment.
- B. DDC static (differential) air pressure measuring station. Refer to Specification Section 23 09 23 DIRECT DIGITAL CONTROL SYSTEM FOR HVAC
- C. Provide one DDC sensor across each extended surface filter. Provide Petcocks for each gauge or sensor.
- D. Provide one common filter gauge for two-stage filter banks with isolation valves to allow differential pressure measurement.

**2.6 HVAC EQUIPMENT FACTORY FILTERS**

- A. Manufacturer standard filters within fabricated packaged equipment should be specified with the equipment and should adhere to industry standard.
- B. Cleanable filters are not permitted.
- C. Automatic Roll Type filters are not permitted.

**2.7 FILTER RETURN GRILLES**

Refer to Section 23 37 00 AIR OUTLETS AND INLETS.

**PART 3 - EXECUTION**

**3.1 INSTALLATION**

- A. Install supports, filters and gages in accordance with manufacturer's instructions.

**3.2 START-UP AND TEMPORARY USE**

- A. Clean and vacuum air handling units and plenums prior to starting air handling systems.
- B. Replace Pre-filters and install clean filter units prior to final inspection as directed by the Resident Engineer.

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**SECTION 23 73 00  
INDOOR CENTRAL-STATION AIR-HANDLING UNITS**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

- A. Air handling units including integral components specified herein.
- B. Definitions: Air Handling Unit (AHU): A factory fabricated and tested assembly of modular sections consisting of multiple plenum fans with direct-drive , coils, filters, and other necessary equipment to perform one or more of the following functions of circulating, cleaning, heating, cooling, humidifying, dehumidifying, and mixing of air. Design capacities of units shall be as scheduled on the drawings.

**1.2 RELATED WORK**

- A. Seismic restraints for equipment: Section 13 05 41, SEISMIC RESTRAINT REQUIREMENTS FOR NON-STRUCTURAL COMPONENTS.
- B. General mechanical requirements and items, which are common to more than one section of Division 23: Section 23 05 11, COMMON WORK RESULTS FOR HVAC AND STEAM GENERATION.
- C. Sound and vibration requirements: Section 23 05 41, NOISE AND VIBRATION CONTROL FOR HVAC PIPING AND EQUIPMENT.
- D. Piping and duct insulation: Section 23 07 11, HVAC, PLUMBING, AND BOILER PLANT INSULATION.
- E. Piping and valves: Section 23 21 13 / 23 22 13, HYDRONIC PIPING / STEAM AND CONDENSATE HEATING PIPING.
- F. Heating and cooling coils and pressure requirements: Section 23 82 16, AIR COILS.
- G. Exhaust fans: Section 23 34 00, HVAC FANS.
- H. Requirements for flexible duct connectors, sound attenuators and sound absorbing duct lining, and air leakage: Section 23 31 00, HVAC DUCTS and CASINGS.
- I. Air filters and filters' efficiency: Section 23 40 00, HVAC AIR CLEANING DEVICES.
- J. HVAC controls: Section 23 09 23, DIRECT-DIGITAL CONTROL SYSTEM FOR HVAC.
- K. Testing, adjusting and balancing of air and water flows: Section 23 05 93, TESTING, ADJUSTING, AND BALANCING FOR HVAC.
- L. Types of motors: Section 23 05 12, GENERAL MOTOR REQUIREMENTS FOR HVAC AND STEAM GENERATION EQUIPMENT.
- M. Types of motor starters: Section 26 29 11, LOW-VOLTAGE MOTOR STARTERS.
- N. General Commissioning: Section 01 91 00, GENERAL COMMISSIONING REQUIREMENTS
- O. HVAC Commissioning: Section 23 08 00, COMMISSIONING OF HVAC SYSTEMS

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**1.3 QUALITY ASSURANCE**

- A. Refer to Article, Quality Assurance, in Section 23 05 11, COMMON WORK RESULTS FOR HVAC AND STEAM GENERATION.
- B. Air Handling Units Certification
  - 1. Air Handling Units with Plenum Fans:
    - a. Air handling Units with Multiple Fans in an Array shall be tested and rated in accordance with AHRI 430 and AHRI 260.
- C. Heating, Cooling, and Air Handling Capacity and Performance Standards: AHRI 430, AHRI 410, ASHRAE 51, and AMCA 210.
- D. Performance Criteria:
  - 1. The fan BHP shall include all system effects for all fans and v-belt drive losses for housed centrifugal fans.
  - 2. The fan motor shall be selected within the rated nameplate capacity, without relying upon NEMA Standard Service Factor.
  - 3. Select the fan operating point as follows:
    - a. Air Foil, Backward Inclined, or Tubular Fans Including Plenum Fans: At or near the peak static efficiency but at an appropriate distance from the stall line.
  - 4. Operating Limits: AMCA 99 and Manufacturer's Recommendations.
- E. Units shall be factory-fabricated, assembled, and tested by a manufacturer, in business of manufacturing similar air-handling units for at least five (5) years.
- F. Unit shall be disassembled into modular sections for shipping and reassembled at final installation location. Unit shall be subjected to leakage test by factory technician on-site, with adjustments and sealing performed to achieve specified leakage performance.

**1.4. SUBMITTALS:**

- A. The contractor shall, in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES, furnish a complete submission for all air handling units covered in the project. The submission shall include all information listed below. Partial and incomplete submissions shall be rejected without reviews.
- B. Manufacturer's Literature and Data:
  - 1. Submittals for AHUs shall include fans, drives, motors, coils, humidifiers, outsideair dampers, filter housings, , and all other related accessories. The contractor shall provide custom drawings showing total air handling unit assembly including dimensions, operating weight, access sections, , flexible connections, door swings, controls penetrations, electrical disconnect, lights, duplex

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- receptacles, switches, wiring, utility connection points, unit support system, vibration isolators, drain pan, pressure drops through each component (filter, coil etc).
2. Submittal drawings of section or component only will not be acceptable. Contractor shall also submit performance data including performance test results, charts, curves or certified computer selection data; data sheets; fabrication and insulation details. If the unit cannot be shipped in one piece, the contractor shall indicate the number of pieces that each unit will have to be broken into to meet shipping and job site rigging requirements. This data shall be submitted in hard copies and in electronic version compatible to AutoCAD version used by the VA at the time of submission.
  3. Submit sound power levels in each octave band for the inlet and discharge of the fans and at entrance and discharge of AHUs at scheduled conditions.
  4. Provide fan curves showing Liters/Second (cubic feet per minute), static pressure, efficiency, and horsepower for current and future flow rates and pressures as indicated on the AHU schedule, and at maximum design Liters/Second (cubic feet per minute).
  5. Submit total fan static pressure, external static pressure, for AHU including total, inlet and discharge pressures, and itemized specified internal losses and unspecified internal losses. Refer to air handling unit schedule on drawings.
- C. Maintenance and operating manuals in accordance with Section 01 00 00, GENERAL REQUIREMENTS. Include instructions for lubrication, filter replacement, motor and drive replacement, spare part lists, and wiring diagrams.
- D. Submit written test procedures two weeks prior to factory testing. Submit written results of factory tests for approval prior to shipping.
- E. Submit shipping information that clearly indicates how the units will be shipped in compliance with the descriptions below.
1. Units shall be shipped in one (1) piece where possible and in shrink wrapping to protect the unit from dirt, moisture and/or road salt.
  2. If not shipped in one (1) piece, provide manufacturer approved shipping splits where required for installation or to meet shipping and/or job site rigging requirements in modular sections. Indicate clearly that the shipping splits shown in the submittals have been verified to accommodate the construction constraints for rigging as required to complete installation and removal of any section for

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replacement through available access without adversely affecting other sections.

3. If shipping splits are provided, each component shall be individually shrink wrapped to protect the unit and all necessary hardware (e.g. bolts, gaskets etc.) will be included to assemble unit on site (see section 2.1.A4).
4. Lifting lugs will be provided to facilitate rigging on shipping splits and joining of segments. If the unit cannot be shipped in one piece, the contractor shall indicate the number of pieces that each unit will have to be broken into to meet shipping and job site rigging requirements.

**1.5 APPLICABLE PUBLICATIONS**

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.
- B. Air-Conditioning, Heating, and Refrigeration Institute (AHRI)/(ARI):  
410-01 .....Standard for Forced-Circulation Air-Heating and  
Air-Cooling Coils  
430-09 .....Central Station Air Handling Units
- C. Air Movement and Control Association International, Inc. (AMCA):  
210-07 .....Laboratory Methods of Testing Fans for Rating
- D. American Society of Heating, Refrigerating and Air-conditioning  
Engineers, Inc. (ASHRAE):  
170-2008 .....Ventilation of Health Care Facilities
- E. American Society for Testing and Materials (ASTM):  
ASTM B117-07a .....Standard Practice for Operating Salt Spray (Fog)  
Apparatus  
ASTM D1654-08 .....Standard Test Method for Evaluation of Painted  
or Coated Specimens Subjected to Corrosive  
Environments  
ASTM D1735-08 .....Standard Practice for Testing Water Resistance  
of Coatings Using Water Fog Apparatus  
ASTM D3359-08 .....Standard Test Methods for Measuring Adhesion by  
Tape Test
- F. Military Specifications (Mil. Spec.):  
MIL-P-21035B-2003 .....Paint, High Zinc Dust Content, Galvanizing  
Repair (Metric)
- G. National Fire Protection Association (NFPA):  
NFPA 90A .....Standard for Installation of Air Conditioning  
and Ventilating Systems, 2009

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H. Energy Policy Act of 2005 (P.L.109-58)

**PART 2 - PRODUCTS**

**2.1 AIR HANDLING UNITS**

**A. General:**

1. AHUs shall be fabricated from insulated, solid double-wall galvanized steel without any perforations in draw-through configuration. Casing shall be fabricated as specified in section 2.1.C.2. Galvanizing shall be hot dipped conforming to ASTM A525 and shall provide a minimum of 0.275 kg of zinc per square meter (0.90 oz. of zinc per square foot) (G90). Aluminum constructed units, subject to VA approval, may be used in place of galvanized steel. The unit manufacturer shall provide published documentation confirming that the structural rigidity of aluminum air-handling units is equal or greater than the specified galvanized steel.
2. The contractor and the AHU manufacturer shall be responsible for ensuring that the unit will not exceed the allocated space shown on the drawings, including required clearances for service and future overhaul or removal of unit components. All structural, piping, wiring, and ductwork alterations of units, which are dimensionally different than those specified, shall be the responsibility of the contractor at no additional cost to the government.
3. AHUs shall be fully assembled by the manufacturer in the factory in accordance with the arrangement shown on the drawings. The unit shall be assembled into the largest sections possible subject to shipping and rigging restrictions. The correct fit of all components and casing sections shall be verified in the factory for all units prior to shipment. All units shall be fully assembled, tested, and then split to accommodate shipment and job site rigging. On units not shipped fully assembled, the manufacturer shall tag each section and include air flow direction to facilitate assembly at the job site. Lifting lugs or shipping skids shall be provided for each section to allow for field rigging and final placement of unit.
4. The AHU manufacturer shall provide the necessary gasketing, caulking, and all screws, nuts, and bolts required for assembly. The manufacturer shall provide a factory-trained and qualified local representative at the job site to supervise the assembly and to assure that the units are assembled to meet manufacturer's recommendations and requirements noted on the drawings. Provide documentation to the Contracting Officer that the local representative has provided services of similar magnitude and

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complexity on jobs of comparable size. If a local representative cannot be provided, the manufacturer shall provide a factory representative.

5. Gaskets: All door and casing and panel gaskets and gaskets between air handling unit components, if joined in the field, shall be high quality which seal air tight and retain their structural integrity and sealing capability after repeated assembly and disassembly of bolted panels and opening and closing of hinged components. Bolted sections may use a more permanent gasketing method provided they are not disassembled.
6. Structural Rigidity: Provide structural reinforcement when required by span or loading so that the deflection of the assembled structure shall not exceed 1/200 of the span based on a differential static pressure of 1991 PA (8 inch WG) or higher.

**B. Base:**

1. Provide a heavy duty steel base for supporting all major AHU components. Bases shall be constructed of wide-flange steel I-beams, channels, or minimum 125 mm (5 inch) high 3.5 mm (10 Gauge) steel base rails. Welded or bolted cross members shall be provided as required for lateral stability. Contractor shall provide supplemental steel supports as required to obtain proper operation heights for cooling coil condensate drain trap and as shown on drawings.
2. AHUs shall be completely self supporting for installation on concrete housekeeping pad, as shown on drawings.
3. The AHU bases not constructed of galvanized steel shall be cleaned, primed with a rust inhibiting primer, and finished with rust inhibiting exterior enamel.

**C. Casing (including wall, floor and roof):**

1. General: AHU casing shall be constructed as solid double wall, galvanized steel insulated panels without any perforations, integral of or attached to a structural frame. The thickness of insulation, mode of application and thermal breaks shall be such that there is no visible condensation on the exterior panels of the AHU located in the non-conditioned spaces.
2. Casing Construction:

Table 2.1.C.2

Outer Panel	0.8 mm (22 Gage) Minimum
Inner Panel	0.8 mm (22 Gage) Minimum
Insulation Thickness	Foam 50 mm (2 inch) Minimum

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Density	48 kg/m <sup>3</sup> (3.0 lb/ft <sup>3</sup> ) Minimum
Total R Value	2.3 m <sup>2</sup> .K/W (13.0 ft <sup>2</sup> .°F.hr/Btu) Minimum

3. Casing Construction (Contractor's Option):

Table 2.1.C.3

Outer Panel	1.3 mm (18 Gage) Minimum
Inner Panel	1.0 mm (20 Gage) Minimum
Insulation	Fiberglass
Thickness	50 mm (2 inch) Minimum
Density	24 kg/m <sup>3</sup> (1.5 lb/ft <sup>3</sup> ) Minimum
Total R Value	1.4 m <sup>2</sup> .K/W (8.0 ft <sup>2</sup> .°F.hr/Btu) Minimum

4. Blank-Off: Provide blank-offs as required to prevent air bypass between the AHU sections, around coils, and filters.
5. Casing panels shall be secured to the support structure with stainless steel or zinc-chromate plated screws and gaskets installed around the panel perimeter. Panels shall be completely removable to allow removal of fan, coils, and other internal components for future maintenance, repair, or modifications. Welded exterior panels are not acceptable.
6. Access Doors: Provide in each access section and where shown on drawings. Show single-sided and double-sided access doors with door swings on the floor plans. Doors shall be a minimum of 50 mm (2 inch) thick with same double wall construction as the unit casing. Doors shall be a minimum of 600 mm (24 inches) wide, unless shown of different size on drawings, and shall be the full casing height up to a maximum of 1850 mm (6 feet). Doors shall be gasketed, hinged, and latched to provide an airtight seal. The access doors for fan section, mixing box, humidifier coil section shall include a minimum 150 mm x 150 mm (6 inch x 6 inch) double thickness, with air space between the glass panes tightly sealed, reinforced glass or Plexiglas window in a gasketed frame.
  - a. Hinges: Manufacturers standard, designed for door size, weight and pressure classifications. Hinges shall hold door completely rigid with minimum 45 kg (100 lb) weight hung on latch side of door.
  - b. Latches: Non-corrosive alloy construction, with operating levers for positive cam action, operable from either inside or outside. Doors that do not open against unit operating pressure shall allow



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the door to ajar and then require approximately 0.785 radian (45 degrees) further movement of the handle for complete opening.

Latch shall be capable of restraining explosive opening of door with a force not less than 1991 Pa (8 inch WG).

- c. Gaskets: Neoprene, continuous around door, positioned for direct compression with no sliding action between the door and gasket.

Secure with high quality mastic to eliminate possibility of gasket slipping or coming loose.

- 7. Provide sealed sleeves, metal or plastic escutcheons or grommets for penetrations through casing for power and temperature control wiring and pneumatic tubing. Coordinate with electrical and temperature control subcontractors for number and location of penetrations. Coordinate lights, switches, and duplex receptacles and disconnect switch location and mounting. All penetrations and equipment mounting may be provided in the factory or in the field. All field penetrations shall be performed neatly by drilling or saw cutting. No cutting by torches will be allowed. Neatly seal all openings airtight.

**D. Floor:**

- 1. Unit floor shall be level without offset space or gap and designed to support a minimum of 488 kg/square meter (100 lbs per square foot) distributed load without permanent deformation or crushing of internal insulation. Provide adequate structural base members beneath floor in service access sections to support typical service foot traffic and to prevent damage to unit floor or internal insulation. Unit floors in casing sections, which may contain water or condensate, shall be watertight with drain pan.
- 2. Where indicated, furnish and install floor drains, flush with the floor, with nonferrous grate cover and stub through floor for external connection.

- E. Condensate Drain Pan:** Drain pan shall be designed to extend entire length of cooling coils including headers and return bends. Depth of drain pan shall be at least 43 mm (1.7 inches) and shall handle all condensate without overflowing. Drain pan shall be double-wall, double sloping type, and fabricated from stainless (304) with at least 50 mm (2 inch) thick insulation sandwiched between the inner and outer surfaces. Drain pan shall be continuous metal or welded watertight. No mastic sealing of joints exposed to water will be permitted. Drain pan shall be placed on top of casing floor or integrated into casing floor assembly. Drain pan shall be pitched in all directions to drain line.

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1. An intermediate, stainless-steel (304) condensate drip pan with copper downspouts shall be provided on stacked cooling coils. Use of intermediate condensate drain channel on upper casing of lower coil is permissible provided it is readily cleanable. Design of intermediate condensate drain shall prevent upper coil condensate from flowing across face of lower coil.
  2. Drain pan shall be piped to the exterior of the unit. Drain pan shall be readily cleanable.
  3. Installation, including frame, shall be designed and sealed to prevent blow-by.
- F. Plenum Fans - Single and/or Multiple Fans in an Array:
1. General: Fans shall be Class II (minimum) construction with single inlet, aluminum wheel and stamped air-foil aluminum bladed. The fan wheel shall be mounted on the directly-driven motor shaft in AMCA Arrangement 4. Fans shall be dynamically balanced and internally isolated to minimize the vibrations. Provide a steel inlet cone for each wheel to match with the fan inlet. Locate fan in the air stream to assure proper flow. The fan performance shall be rated in accordance with AMCA 210 or ASHRAE 51.
  2. Allowable vibration tolerances for fan shall not exceed a self-excited vibration maximum velocity of 0.005 m/s (0.20 inch per second) RMS, filter in, when measured with a vibration meter on bearing caps of machine in vertical, horizontal and axial directions or measured at equipment mounting feet if bearings are concealed. After field installation, compliance to this requirement shall be demonstrated with field test in accordance with Section 23 05 41, NOISE AND VIBRATION CONTROL FOR HVAC PIPING AND EQUIPMENT and Section 23 05 93, TESTING, ADJUSTING, AND BALANCING FOR HVAC. Following fan assembly, the complete fan assembly balance shall be tested using an electronic balance analyzer with a tunable filter and stroboscope. Vibration measurements shall be taken on each motor bearing housing in the vertical, horizontal, and axial planes (5 total measurements, 2 each motor bearing and 1 axial).
  3. The plenum fans shall be driven by variable speed drives with at least one back-up drive as shown in the design documents. Use of a drive with bypass is not permitted.
  4. Multiple fans shall be installed in a pre-engineered structural frame to facilitate fan stacking. All fans shall modulate in unison, above or below the synchronous speed within the limits specified by the manufacturer, by a common control sequence. Staging of the fans is permitted due to low flow condition of project load versus the total

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flow of the final air system distribution to future areas outside of the project area. Redundancy requirement shall be met by all operating fans in an array and without the provision of an idle standby fan.

5. Fan Accessories

- a. Fan Isolation: Provide an automatic back draft damper to isolate the fan not in operation due to failure.
- b. Fan Airflow Measurement: Provide an airflow measuring device integral to the fan to measure air volume within +/- 5 percent accuracy. The probing device shall not be placed in the airflow path to stay clear of turbulence and avoid loss of performance.

G. Fan Motor, Drive, and Mounting Assembly (Plenum Fans):

Fan Motor and Drive: Motors shall be premium energy efficient type, as mandated by the Energy Policy Act of 2005, with efficiencies as shown in the Specifications Section 23 05 12 (General Motor Requirements For HVAC and Steam Equipment), on drawings and suitable for use in variable frequency drive applications. Refer to Section 23 05 11, COMMON WORK RESULTS FOR HVAC AND STEAM GENERATION, for additional motor and drive specifications. Refer to Specification Section 26 29 11, LOW-VOLTAGE MOTOR STARTERS

- H. Damper blades shall be galvanized steel or aluminum type. Dampers shall have metal compressible jamb seals and extruded vinyl or metal blade edge seals. Dampers shall rotate on stainless steel bearings or bronze bushings. Leakage rate shall not exceed 2.5 cubic meters/minute/square meter (8 CFM per sq. foot) at 250 Pa (1 inch WG). Dampers and operators shall be furnished and factory installed by AHU manufacturer. Damper operators shall be of the same manufacturer as controls furnished under Section 23 09 23, DIRECT-DIGITAL CONTROL SYSTEM FOR HVAC. L.

Intake Boxes: Intake box shall consist of casing and outdoor air dampers in opposed blade arrangement with damper linkage for automatic operation. Coordinate damper operator with Section 23 09 23, DIRECT-DIGITAL CONTROL SYSTEM FOR HVAC. Dampers shall be of ultra-low leak design with metal compressible bronze jamb seals and extruded vinyl edge seals on all blades. Blades shall rotate on stainless steel sleeve bearings or bronze bushings. Leakage rate shall not exceed 1.6 cubic meters/min/square meter (5 CFM per square foot) at 250 Pa (1 inch WG) and 2.8 cubic meters/min/square meter (9 CFM per square foot) at 995 Pa (4 inch WG) Electronic operators shall be furnished and mounted in an accessible and easily serviceable location by the air handling unit manufacturer at the factory. Damper operators shall be of same

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manufacturer as controls furnished under Section 23 09 23, DIRECT-DIGITAL CONTROL SYSTEM FOR HVAC.

- I. Filter Section: Refer to Section 23 40 00, HVAC AIR CLEANING DEVICES, for filter requirements.
  - 1. Filters including one complete set for temporary use at site shall be provided independent of the AHU. The AHU manufacturer shall install filter housings and racks in filter section compatible with filters furnished. The AHU manufacturer shall be responsible for furnishing temporary filters (pre-filters and after-filters, as shown on drawings) required for AHU testing.
  - 2. Factory-fabricated filter section shall be of the same construction and finish as the AHU casing including filter racks and hinged double wall access doors. Filter housings shall be constructed in accordance with side service or holding frame housing requirements in Section 23 40 00, HVAC AIR CLEANING DEVICES.
- J. Coils: Coils shall be mounted on hot dipped galvanized steel supports to assure proper anchoring of coil and future maintenance. Coils shall be face or side removable for future replacement thru the access doors or removable panels. Each coil shall be removable without disturbing adjacent coil. Cooling coils shall be designed and installed to insure no condensate carry over. Provide factory installed extended supply, return, drain, and vent piping connections. All coils in the high humidity areas, shall be epoxy-coated as shown below// Refer to Drawings and Section 23 82 16, AIR COILS for additional coil requirements.
  - 1. Water Coils, Including Glycol-Water.
- K. Humidifier: When included in design, coordinate the humidification requirements with section 23 22 13 Steam and Condensate Heating Piping. Provide air-handling unit-mounted humidification section with stainless steel drain pan of adequate length to allow complete absorption of water vapor. Provide stainless steel dispersion panel or distributors as indicated, with stainless steel supports and hardware.
- L. Discharge Section:

Provide aerodynamically designed framed discharge openings or spun bellmouth fittings to minimize pressure loss.
- M. Electrical and Lighting: Wiring and equipment specifications shall conform to Division 26, ELECTRICAL.
  - 1. Vapor-proof lights using cast aluminum base style with glass globe and cast aluminum guard shall be installed in access sections for fan, mixing box, humidifier and any section over 300 mm (12 inch) wide. A switch shall control the lights in each compartment with

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- pilot light mounted outside the respective compartment access door. Wiring between switches and lights shall be factory installed. All wiring shall run in neatly installed electrical conduits and terminate in a junction box for field connection to the building system. Provide single point 115 volt - one phase connection at junction box.
2. Install compatible 100 watt bulb in each light fixture.
  3. Provide a convenience duplex weatherproof receptacle next to the light switch.
  4. Disconnect switch and power wiring: Provide factory or field mounted disconnect switch. Coordinate with Division 26, ELECTRICAL.

**PART 3 - EXECUTION**

**3.1 INSTALLATION**

- A. Install air handling unit in conformance with ARI 435.
- B. Assemble air handling unit components following manufacturer's instructions for handling, testing and operation. Repair damaged galvanized areas with paint in accordance with Military Spec. DOD-P-21035. Repair painted units by touch up of all scratches with finish paint material. Vacuum the interior of air handling units clean prior to operation.
- C. Leakage and test requirements for air handling units shall be the same as specified for ductwork in Specification Section 23 31 00, HVAC DUCTS AND CASINGS except leakage shall not exceed Leakage Class ( $C_L$ ) 12 listed in SMACNA HVAC Air Duct Leakage Test Manual when tested at 1.5 times the design static pressure. Perform leakage tests at factory and on-site. Repair casing air leaks that can be heard or felt during normal operation and to meet test requirements.
- D. Perform field mechanical (vibration) balancing in accordance with Section 23 05 41, NOISE AND VIBRATION CONTROL FOR HVAC PIPING AND EQUIPMENT.
- E. Seal and/or fill all openings between the casing and AHU components and utility connections to prevent air leakage or bypass.

**3.2 STARTUP SERVICES**

- A. The air handling unit shall not be operated for any purpose, temporary or permanent, until ductwork is clean, filters are in place, bearings are lubricated and fan has been test run under observation.
- B. After the air handling unit is installed and tested, provide startup and operating instructions to VA personnel.
- C. An authorized factory representative should start up, test and certify the final installation and application specific calibration of control components. Items to be verified include fan performance over entire

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operating range, noise and vibration testing, verification of proper alignment, overall inspection of the installation, Owner/Operator training, etc.

**3.3 COMMISSIONING**

- A. Provide commissioning documentation in accordance with the requirements of Section 23 08 00 - COMMISSIONING OF HVAC SYSTEMS for all inspection, start up, and contractor testing required above and required by the System Readiness Checklist provided by the Commissioning Agent.
- B. Components provided under this section of the specification will be tested as part of a larger system. Refer to Section 23 08 00 - COMMISSIONING OF HVAC SYSTEMS and related sections for contractor responsibilities for system commissioning.

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SECTION 23 82 00  
CONVECTION HEATING AND COOLING UNITS

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

Induction units, fan-coil units, and convectors and finned-tube radiation.

**1.2 RELATED WORK**

- A. Section 13 05 41, SEISMIC RESTRAINT REQUIREMENTS FOR NON-STRUCTURAL COMPONENTS: Seismic restraints for equipment.
- B. Section 23 05 11, COMMON WORK RESULTS FOR HVAC: General mechanical requirements and items, which are common to more than one section of Division 23.
- C. Section 23 05 41, NOISE and VIBRATION CONTROL FOR HVAC PIPING and EQUIPMENT: Noise requirements.
- D. Section 23 21 13, HYDRONIC PIPING: Heating hot water and chilled water piping.
- E. Section 23 31 00, HVAC DUCTS and CASINGS: Ducts and flexible connectors.
- F. Section 23 09 23, DIRECT-DIGITAL CONTROL SYSTEM FOR HVAC: Valve operators.
- G. Section 23 05 93, TESTING, ADJUSTING, and BALANCING FOR HVAC: Flow rates adjusting and balancing.
- H. Section 23 82 16, AIR COILS: Additional coil requirements.
- I. Section 23 08 00 - COMMISSIONING OF HVAC SYSTEMS: Requirements for commissioning, systems readiness checklists, and training.
- J. Section 01 09 00 - GENERAL COMMISSIONING REQUIREMENTS

**1.3 QUALITY ASSURANCE**

Refer to Paragraph, QUALITY ASSURANCE, in Section 23 05 11, COMMON WORK RESULTS FOR HVAC.

**1.4 SUBMITTALS**

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, and SAMPLES.
- B. Manufacturer's Literature and Data:
  - 1. Induction units.
  - 2. Fan-Coil units.
  - 3. Convectors.
  - 4. Finned-tube radiation.



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C. Certificates:

1. Compliance with paragraph, QUALITY ASSURANCE.
2. Compliance with specified standards.

D. Operation and Maintenance Manuals: Submit in accordance with paragraph, INSTRUCTIONS, in Section 01 00 00, GENERAL REQUIREMENTS.

E. Completed System Readiness Checklists provided by the Commissioning Agent and completed by the contractor, signed by a qualified technician and dated on the date of completion, in accordance with the requirements of Section 23 08 00 COMMISSIONING OF HVAC SYSTEMS.

**1.5 APPLICABLE PUBLICATIONS**

A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.

B. American National Standards Institute / Air Conditioning, Heating and Refrigeration Institute (ANSI/AHRI):

440-08 .....Performance Rating of Room Fan Coils

National Fire Protection Association (NFPA):

90A-09 .....Standard for the Installation of Air  
Conditioning and Ventilating Systems

70-11 .....National Electrical Code

C. Underwriters Laboratories, Inc. (UL):

181-08 .....Standard for Factory-Made Air Ducts and Air  
Connectors

1995-05 .....Heating and Cooling Equipment

**1.6 GUARANTY**

In accordance with FAR clause 52.246-21.

**PART 2 - PRODUCTS**

**2.1 INDUCTION UNITS**

- A. General: Induction units shall be horizontal cabinet style suitable for location within room at ceiling level. Base unit shall include cabinet enclosure, air plenums, air-discharge nozzles, air discharge grilles, recirculation grilles, water coil assembly, valve and piping package, condensate drain pan, and an adjustable air-balancing damper. Each unit shall be selected to produce the capacity shown on the drawings, without exceeding the specified static pressure or scheduled noise levels.

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- B. Enclosure: Construct of galvanized steel minimum 1.3 mm (18 gage), reinforced and braced. Front panel of enclosure shall be removable. Discharge grilles shall be adjustable and shall be of such design as to distribute air throughout the conditioned space. Plastic discharge and return grilles are not acceptable. Provide swing down access doors for all piping, service, and control compartments including lint screen. Color of the enclosure shall be Benjamin Moore OC-117 "Simply White". Provide pipe and duct openings for all connections.
- C. Air Plenums: Construct air plenums of galvanized steel with interior acoustically baffled and lined with sound absorbing materials that will attenuate the sound power from the primary air supply to the room. Lining shall be 13 mm (0.5 inch) thick (2.5 lb/ft<sup>3</sup>) density neoprene coated glass fiber. Heat-resistant nozzles shall be integral with or attached airtight to the plenum. Provide a streamline, vaned mitered elbow transition piece for connection between the unit and ductwork. Provide transition from oval to round duct. Provide an adjustable air-balancing damper in each unit.
- D. Water Coils: Provide single water coil for heating and cooling. Seamless copper tubing, with copper or aluminum fins, mechanically bonded or soldered to the tubes, suitable for 1378 kPa (200 psig) working pressure. Provide coil connections with no less than 11 mm (7/16-inch) outside diameter flare or sweat connectors, accessory piping package with shut-off valves and terminal connections suitable for connection to the type of control valve supplied, and manual air vent. Test coils hydrostatically at 2067 kPa (300 psig) or under water at 1722 kPa (250 psig) air pressure. Refer to Drawings and Section 23 82 16, AIR COILS, for additional coil requirements.
- E. Provide easily accessible lint screen for each unit.
- F. Drain or Auxiliary Pans: Galvanized steel, watertight, and properly sized and located to collect all condensed water dripping from any item within the unit enclosure. Provide drain connection when a condensate drain system is indicated. Connection shall be minimum 11/16 ODF sweat.
- G. Valve Assembly: Provide packaged valve assembly including isolation valves, strainers, automatic balancing control valve, check valves, and control valves from controls vendor. Entire assembly to fit within unit enclosure and arranged for easy access for service.

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**2.2 ROOM FAN-COIL UNITS**

- A. Capacity Certification: AHRI 440.
- B. Safety Compliance: NEC compliant and UL listed.
- C. Noise Levels: Operating at full cooling capacity, sound power level shall not exceed by more than 5 dB the numerical value of sound pressure levels associated with noise criteria specified in Section 23 05 51, NOISE AND VIBRATION CONTROL FOR HVAC PIPING AND EQUIPMENT. Select units at intermediate speed, for compliance with the noise criteria.
- D. Chassis: Galvanized steel, acoustically and thermally insulated to attenuate noise and prevent condensation.
- E. Cabinet (only for exposed units): Minimum 1.3 mm (18 gage) steel reinforced and braced. Arrange components and provide adequate space for installation of piping package and control valves. Finish shall be factory-baked enamel color as selected by the architect on all exposed surfaces.
  - 2. Horizontal Unit: Provide Concealed type as shown. Provide supports and vibration isolators for horizontal units as recommended by the manufacturer.
    - a. Concealed Units: Provide furred-in type with return plenum and inlet duct collar and outlet duct collar.
- F. Fans: Centrifugal, forward curved, double width type wheels, galvanized steel or polyester resin construction, statically and dynamically balanced, direct driven.
  - 1. Motors: Premium efficiency, 3-speed permanent split capacitor type with integral thermal overload protection, for operation at not more than 1200 RPM.
  - 2. Provide a fan speed selector switch, with off, low, medium, and high positions. Switch shall have a set of auxiliary contacts which are open when the switch is in the "off" position and closed when the switch in any of the other positions. On ceiling-suspended horizontal concealed units, switch shall be mounted on the chassis of the unit, above the ceiling in a serviceable location.
- G. Cooling and Heating Coils:
  - 1. Hydronic (two separate coils for cooling and heating): Copper tubes, 10 mm (three-eighths inch) minimum inside diameter, not less than 4.3 mm (0.017 inch) thick with copper or aluminum fins. Coils shall

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be pressure tested for bursting and strength in accordance with Underwriters Laboratories, Inc., requirements for pressure tested coils, and shall be designed to provide adequate heat transfer capacity. Provide manual air vent at high point of each coil and drain at each low point.

- H. Piping Package: Field-installed by the contractor to fit control valves provided by the controls supplier. Submit manufacturer's detailed drawings of the piping in the end compartments for approval prior to fabrication of the piping packages. Provide ball stop valves on the supply and return pipes and balancing fittings on the return pipes.
- I. Drain pans: Furnish galvanized steel with solderless drain connections and molded polystyrene foam insulating liner: Include a water detection device to deactivate the cooling in the unit.
  - 1. Auxiliary drain pan: Located under control valve and piping within the unit enclosure to prevent dripping.
- J. Air Filter: Manufacturer's standard throwaway type, not less than 25 mm (1 inch) thick, MERV 7, supported to be concealed from sight and be tight fitting to prevent air by-pass. Filters shall have slide out frames and be easily replaced without removing enclosure or any part thereof.
- K. Control valves and remote wall mounted space temperature sensors are to be field installed. Provide two-way modulating control valves unless shown or specified otherwise.

**2.3 CONVECTORS**

- A. Ratings: In accordance with AHRI 445. Provide convector element of length and capacity as indicated on drawings.

Provide easy access to heating elements, valves and controls.
- 1. Fully recessed units: Flanged enclosure with 13 mm (1/2-inch) thick fiber-glass insulation on the back.
- 2. Steam Heating Elements: Copper tubing expanded into cast iron or cast brass headers and aluminum fins with integral collars bonded by mechanical expansion of tubing. Elements shall withstand 690 kPa (100 psig) air pressure when factory tested under water.
- 3. Provide field installed remote wall mounted thermo-mechanical thermostats where shown or specified on steam units to operate the unit control valve.

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**2.4 FINNED-TUBE RADIATION**

- A. Ratings: Certified under the I=B=R program of the Gas Appliance Manufacturer's Association.
- B. Enclosures: End plates and corner pieces shall be die-formed with round edges and fit flush with enclosure surface. Where continuous wall-to-wall installations are shown on the drawings provide all fillers, corner fittings, sleeves, end caps and other accessories, which shall have the same profile as the basic unit. Provide access panels or extensions where required for access to valves, or traps shown on the drawings.
- C. Hydronic/Steam Heating Elements: Steel pipe or nonferrous tubing with fins mechanically bonded by mechanical expansion of the tube. Elements shall be positively positioned front-to-back with provisions for silent horizontal expansion and contraction.

**PART 3 - EXECUTION**

**3.1 INSTALLATION**

- A. Locate all equipment with cooling condensate drain pans as high as possible to maximize drainage by gravity into the CCD piping system.
- B. Work shall be installed as shown and according to the manufacturer's diagrams and recommendations.
- C. Handle and install units in accordance with manufacturer's written instructions.
- D. Support units rigidly so they remain stationary at all times. Cross-bracing or other means of stiffening shall be provided as necessary. Method of support shall be such that distortion and malfunction of units cannot occur. Provide seismic bracing per section 23 05 41, Noise and Vibration Control for HVAC Piping and Equipment. Also refer to Section 13 05 41.

**3.2 OPERATIONAL TEST**

Refer to Section 23 05 11, COMMON WORK RESULTS FOR HVAC.

**3.3 STARTUP AND TESTING**

- A. The Commissioning Agent will observe startup and contractor testing of selected equipment. Coordinate the startup and contractor testing schedules with the Resident Engineer and Commissioning Agent. Provide a minimum of 7 days prior notice.

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**3.4 COMMISSIONING**

- A. Provide commissioning documentation in accordance with the requirements of Section 23 08 00 - COMMISSIONING OF HVAC SYSTEMS for all inspection, start up, and contractor testing required above and required by the System Readiness Checklist provided by the Commissioning Agent.
- B. Components provided under this section of the specification will be tested as part of a larger system. Refer to Section 23 08 00 - COMMISSIONING OF HVAC SYSTEMS and related sections for contractor responsibilities for system commissioning.

**3.5 DEMONSTRATION AND TRAINING**

- A. Provide services of manufacturer's technical representative for four hours to instruct VA personnel in operation and maintenance of units.
- B. Submit training plans and instructor qualifications in accordance with the requirements of Section 23 08 00 - COMMISSIONING OF HVAC SYSTEMS.

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SECTION 23 82 16  
AIR COILS

PART 1 - GENERAL

1.1 DESCRIPTION

Heating and cooling coils for air handling unit and duct applications

1.2 RELATED WORK

- A. Section 23 05 10, COMMON WORK RESULTS FOR BOILER PLANT and STEAM GENERATION.
- B. Section 23 05 11, COMMON WORK RESULTS FOR HVAC.
- C. Section 23 31 00, HVAC DUCTS AND CASINGS
- D. Section 23 36 00, AIR TERMINAL UNITS: Reheat coils for VAV/CV terminals.
- E. Section 23 73 00, INDOOR CENTRAL-STATION AIR-HANDLING UNITS.
- G. Section 23 82 00, CONVECTION HEATING AND COOLING UNITS
- H. Section 01 91 00, GENERAL COMMISSIONING REQUIREMENTS

1.3 QUALITY ASSURANCE

- A. Refer to paragraph, QUALITY ASSURANCE, Section 23 05 11, COMMON WORK RESULTS FOR HVAC.
- B. Unless specifically exempted by these specifications, heating and cooling coils shall be tested, rated, and certified in accordance with AHRI Standard 410 and shall bear the AHRI certification label.

1.4 SUBMITTALS

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, and SAMPLES.
- B. Manufacturer's Literature and Data for Heating and Cooling Coils: Submit type, size, arrangements and performance details. Present application ratings in the form of tables, charts or curves.
- C. Provide installation, operating and maintenance instructions.
- D. Certification Compliance: Evidence of listing in current ARI Directory of Certified Applied Air Conditioning Products.
- E. Coils may be submitted with Section 23 73 00, INDOOR CENTRAL-STATION AIR-HANDLING UNITS, Section 23 36 00, AIR TERMINAL UNITS, or Section 23 82 00, CONVECTION HEATING AND COOLING UNITS.

1.5 APPLICABLE PUBLICATIONS

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.
- B. Air Conditioning and Refrigeration Institute (AHRI):  
Directory of Certified Applied Air Conditioning Products  
AHRI 410-01 .....Forced-Circulation Air-Cooling and Air-Heating  
Coils



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- C. American Society for Testing and Materials (ASTM):  
B75/75M-02 .....Standard Specifications for Seamless Copper Tube
- D. National Fire Protection Association (NFPA):  
70-11 .....National Electric Code

**PART 2 - PRODUCTS**

**2.1 HEATING AND COOLING COILS**

- A. Conform to ASTM B75 and AHRI 410.
- B. Tubes: Minimum 16 mm (0.625 inch) tube diameter; Seamless copper tubing.
- C. Fins: 0.1397 mm (0.0055 inch) aluminum or 0.1143 mm (0.0045 inch) copper mechanically bonded or soldered or helically wound around tubing.
- D. Headers: Copper, welded steel or cast iron. Provide seamless copper tubing or resistance welded steel tube for volatile refrigerant coils.
- E. "U" Bends, Where Used: Machine die-formed, silver brazed to tube ends.
- F. Coil Casing: 1.6 mm (16 gage) galvanized steel with tube supports at 1200 mm (48 inch) maximum spacing. Construct casing to eliminate air bypass and moisture carry-over. Provide duct connection flanges.
- G. Pressures kPa (PSIG):

Pressure	Water Coil
Test	2070 (300)
Working	1380 (200)

- H. Protection: Unless protected by the coil casing, provide cardboard, plywood, or plastic material at the factory to protect tube and finned surfaces during shipping and construction activities.
- I. Vents and Drain: Coils that are not vented or drainable by the piping system shall have capped vent/drain connections extended through coil casing.
- J. Cooling Coil Condensate Drain Pan: Section 23 73 00, INDOOR CENTRAL-STATION AIR-HANDLING UNITS.
- K. Dampers: Interlocking opposed blades to completely isolate coil from air flow when unit is in bypass position; 1.6 mm (16 gage) steel, coated with factory applied corrosion resistant baked enamel finish. Provide damper linkage and electric operators. Damper operators shall be of same manufacturer as controls furnished under Section 23 09 23, DIRECT-DIGITAL CONTROL SYSTEM FOR HVAC. //

**2.2 REHEAT COILS, DUCT MOUNTED**

The coils shall be continuous circuit booster type for steam or hot water as shown on drawings. Use the same coil material as listed in Paragraphs 2.1.

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**2.3 WATER COILS, INCLUDING GLYCOL-WATER**

- A. Use the same coil material as listed in Paragraphs 2.1.
- B. Drainable Type (Self Draining, Self Venting); Manufacturer standard:
  - 1. Cooling, all types.
  - 2. Heating or preheat.

**PART 3 - EXECUTION**

**3.1 INSTALLATION**

- A. Follow coil manufacturer's instructions for handling, cleaning, installation and piping connections.
- B. Comb fins, if damaged. Eliminate air bypass or leakage at coil sections.

**3.2 STARTUP AND TESTING**

- A. The Commissioning Agent will observe startup and contractor testing of selected equipment. Coordinate the startup and contractor testing schedules with the Resident Engineer and Commissioning Agent. Provide a minimum of 7 days prior notice.

**3.3 DEMONSTRATION AND TRAINING**

- A. Provide services of manufacturer's technical representative for four hours to instruct VA personnel in operation and maintenance of units.
- B. Submit training plans and instructor qualifications in accordance with the requirements of Section 23 08 00 - COMMISSIONING OF HVAC SYSTEMS.

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SECTION 26 05 11  
REQUIREMENTS FOR ELECTRICAL INSTALLATIONS

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

- A. This section applies to all sections of Division 26.
- B. Furnish and install electrical systems, materials, equipment, and accessories in accordance with the specifications and drawings. Capacities and ratings of motors, , conductors and cable, , panelboards, and other items and arrangements for the specified items are shown on the drawings.
- C. Conductor ampacities specified or shown on the drawings are based on copper conductors, with the conduit and raceways sized per NEC. Aluminum conductors are prohibited.

**1.2 MINIMUM REQUIREMENTS**

- A. The International Building Code (IBC), National Electrical Code (NEC), Underwriters Laboratories, Inc. (UL), and National Fire Protection Association (NFPA) codes and standards are the minimum requirements for materials and installation.
- B. The drawings and specifications shall govern in those instances where requirements are greater than those stated in the above codes and standards.

**1.3 TEST STANDARDS**

- A. All materials and equipment shall be listed, labeled, or certified by a Nationally Recognized Testing Laboratory (NRTL) to meet Underwriters Laboratories, Inc. (UL), standards where test standards have been established. Materials and equipment which are not covered by UL standards will be accepted, providing that materials and equipment are listed, labeled, certified or otherwise determined to meet the safety requirements of a NRTL. Materials and equipment which no NRTL accepts, certifies, lists, labels, or determines to be safe, will be considered if inspected or tested in accordance with national industrial standards, such as ANSI, NEMA, and NETA. Evidence of compliance shall include certified test reports and definitive shop drawings.
- B. Definitions:
  - 1. Listed: Materials and equipment included in a list published by an organization that is acceptable to the Authority Having Jurisdiction and concerned with evaluation of products or services, that

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- maintains periodic inspection of production or listed materials and equipment or periodic evaluation of services, and whose listing states that the materials and equipment either meets appropriate designated standards or has been tested and found suitable for a specified purpose.
2. Labeled: Materials and equipment to which has been attached a label, symbol, or other identifying mark of an organization that is acceptable to the Authority Having Jurisdiction and concerned with product evaluation, that maintains periodic inspection of production of labeled materials and equipment, and by whose labeling the manufacturer indicates compliance with appropriate standards or performance in a specified manner.
  3. Certified: Materials and equipment which:
    - a. Have been tested and found by a NRTL to meet nationally recognized standards or to be safe for use in a specified manner.
    - b. Are periodically inspected by a NRTL.
    - c. Bear a label, tag, or other record of certification.
  4. Nationally Recognized Testing Laboratory: Testing laboratory which is recognized and approved by the Secretary of Labor in accordance with OSHA regulations.

**1.4 QUALIFICATIONS (PRODUCTS AND SERVICES)**

- A. Manufacturer's Qualifications: The manufacturer shall regularly and currently produce, as one of the manufacturer's principal products, the materials and equipment specified for this project, and shall have manufactured the materials and equipment for at least three years.
- B. Product Qualification:
  1. Manufacturer's materials and equipment shall have been in satisfactory operation, on three installations of similar size and type as this project, for at least three years.
  2. The Government reserves the right to require the Contractor to submit a list of installations where the materials and equipment have been in operation before approval.
- C. Service Qualifications: There shall be a permanent service organization maintained or trained by the manufacturer which will render satisfactory service to this installation within four hours of receipt of notification that service is needed. Submit name and address of service organizations.

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**1.5 APPLICABLE PUBLICATIONS**

- A. Applicable publications listed in all Sections of Division 26 are the latest issue, unless otherwise noted.
- B. Products specified in all sections of Division 26 shall comply with the applicable publications listed in each section.

**1.6 MANUFACTURED PRODUCTS**

- A. Materials and equipment furnished shall be of current production by manufacturers regularly engaged in the manufacture of such items, and for which replacement parts shall be available.
- B. When more than one unit of the same class or type of materials and equipment is required, such units shall be the product of a single manufacturer.
- C. Equipment Assemblies and Components:
  - 1. Components of an assembled unit need not be products of the same manufacturer.
  - 2. Manufacturers of equipment assemblies, which include components made by others, shall assume complete responsibility for the final assembled unit.
  - 3. Components shall be compatible with each other and with the total assembly for the intended service.
  - 4. Constituent parts which are similar shall be the product of a single manufacturer.
- D. Factory wiring and terminals shall be identified on the equipment being furnished and on all wiring diagrams.
- E. When Factory Testing Is Specified:
  - 1. The Government shall have the option of witnessing factory tests. The Contractor shall notify the Government through the CORT a minimum of 15 working days prior to the manufacturer's performing the factory tests.
  - 2. Four copies of certified test reports shall be furnished to the COTR two weeks prior to final inspection and not more than 90 days after completion of the tests.
  - 3. When materials and equipment fail factory tests, and re-testing and re-inspection is required, the Contractor shall be liable for all additional expenses for the Government to witness re-testing.

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**1.7 VARIATIONS FROM CONTRACT REQUIREMENTS**

- A. Where the Government or the Contractor requests variations from the contract requirements, the connecting work and related components shall include, but not be limited to additions or changes to branch circuits, circuit protective devices, conduits, wire, feeders, controls, panels and installation methods.

**1.8 MATERIALS AND EQUIPMENT PROTECTION**

- A. Materials and equipment shall be protected during shipment and storage against physical damage, vermin, dirt, corrosive substances, fumes, moisture, cold and rain.
1. Store materials and equipment indoors in clean dry space with uniform temperature to prevent condensation.
  2. During installation, equipment shall be protected against entry of foreign matter, and be vacuum-cleaned both inside and outside before testing and operating. Compressed air shall not be used to clean equipment. Remove loose packing and flammable materials from inside equipment.
  3. Damaged equipment shall be repaired or replaced, as determined by the Resident Engineer.
  4. Painted surfaces shall be protected with factory installed removable heavy kraft paper, sheet vinyl or equal.
  5. Damaged paint on equipment shall be refinished with the same quality of paint and workmanship as used by the manufacturer so repaired areas are not obvious.

**1.9 WORK PERFORMANCE**

- A. All electrical work shall comply with the requirements of NFPA 70 (NEC), NFPA 70B, NFPA 70E, OSHA Part 1910 subpart J - General Environmental Controls, OSHA Part 1910 subpart K - Medical and First Aid, and OSHA Part 1910 subpart S - Electrical, in addition to other references required by contract.
- B. Job site safety and worker safety is the responsibility of the Contractor.

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- C. Electrical work shall be accomplished with all affected circuits or equipment de-energized. When an electrical outage cannot be accomplished in this manner for the required work, the following requirements are mandatory:
  - 1. Electricians must use full protective equipment (i.e., certified and tested insulating material to cover exposed energized electrical components, certified and tested insulated tools, etc.) while working on energized systems in accordance with NFPA 70E.
  - 2. Before initiating any work, a job specific work plan must be developed by the Contractor with a peer review conducted and documented by the Resident Engineer and Medical Center staff. The work plan must include procedures to be used on and near the live electrical equipment, barriers to be installed, safety equipment to be used, and exit pathways.
  - 3. Work on energized circuits or equipment cannot begin until prior written approval is obtained from the Resident Engineer.
- D. For work that affects existing electrical systems, arrange, phase and perform work to assure minimal interference with normal functioning of the facility. Refer to Article OPERATIONS AND STORAGE AREAS under Section 01 00 00, GENERAL REQUIREMENTS.
- E. New work shall be installed and connected to existing work neatly, safely and professionally. Disturbed or damaged work shall be replaced or repaired to its prior conditions, as required by Section 01 00 00, GENERAL REQUIREMENTS.
- F. Coordinate location of equipment and conduit with other trades to minimize interference.

**1.10 EQUIPMENT INSTALLATION AND REQUIREMENTS**

- A. Equipment location shall be as close as practical to locations shown on the drawings.
- B. Working clearances shall not be less than specified in the NEC.
- C. Inaccessible Equipment:
  - 1. Where the Government determines that the Contractor has installed equipment not readily accessible for operation and maintenance, the equipment shall be removed and reinstalled as directed at no additional cost to the Government.
  - 2. "Readily accessible" is defined as being capable of being reached quickly for operation, maintenance, or inspections without the use



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of ladders, or without climbing or crawling under or over obstacles such as, but not limited to, motors, pumps, belt guards, transformers, piping, ductwork, conduit and raceways.

**1.11 EQUIPMENT IDENTIFICATION**

- A. In addition to the requirements of the NEC, install an identification sign which clearly indicates information required for use and maintenance of items such as panelboards, cabinets, motor controllers, fused and non-fused safety switches, separately enclosed circuit breakers, individual breakers in panelboards, control devices and other significant equipment.
- B. Identification signs for Normal Power System equipment shall be laminated black phenolic resin with a white core with engraved lettering. Identification signs for Essential Electrical System (EES) equipment, as defined in the NEC, shall be laminated red phenolic resin with a white core with engraved lettering. Lettering shall be a minimum of 12 mm (1/2 inch) high. Identification signs shall indicate equipment designation, rated bus amperage, voltage, number of phases, number of wires, and type of EES power branch as applicable. Secure nameplates with screws.
- C. Install adhesive arc flash warning labels on all equipment as required by NFPA 70E. Label shall indicate the arc hazard boundary (inches), working distance (inches), arc flash incident energy at the working distance (calories/cm<sup>2</sup>), required PPE category and description including the glove rating, voltage rating of the equipment, limited approach distance (inches), restricted approach distance (inches), prohibited approach distance (inches), equipment/bus name, date prepared, and manufacturer name and address.

**1.12 SUBMITTALS**

- A. Submit to the Resident Engineer in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. The Government's approval shall be obtained for all materials and equipment before delivery to the job site. Delivery, storage or installation of materials and equipment which has not had prior approval will not be permitted.
- C. All submittals shall include six copies of adequate descriptive literature, catalog cuts, shop drawings, test reports, certifications, samples, and other data necessary for the Government to ascertain that

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the proposed materials and equipment comply with drawing and specification requirements. Catalog cuts submitted for approval shall be legible and clearly identify specific materials and equipment being submitted.

- D. Submittals for individual systems and equipment assemblies which consist of more than one item or component shall be made for the system or assembly as a whole. Partial submittals will not be considered for approval.

1. Mark the submittals, "SUBMITTED UNDER SECTION\_\_\_\_\_".
2. Submittals shall be marked to show specification reference including the section and paragraph numbers.
3. Submit each section separately.

- E. The submittals shall include the following:

1. Information that confirms compliance with contract requirements.  
Include the manufacturer's name, model or catalog numbers, catalog information, technical data sheets, shop drawings, manuals, pictures, nameplate data, and test reports as required.
2. Submittals are required for all equipment anchors and supports.  
Submittals shall include weights, dimensions, center of gravity, standard connections, manufacturer's recommendations and behavior problems (e.g., vibration, thermal expansion, etc.) associated with equipment or piping so that the proposed installation can be properly reviewed. Include sufficient fabrication information so that appropriate mounting and securing provisions may be designed and attached to the equipment.
3. Elementary and interconnection wiring diagrams for communication and signal systems, control systems, and equipment assemblies. All terminal points and wiring shall be identified on wiring diagrams.
4. Parts list which shall include information for replacement parts and ordering instructions, as recommended by the equipment manufacturer.

- F. Maintenance and Operation Manuals:

1. Submit as required for systems and equipment specified in the technical sections. Furnish in hardcover binders or an approved equivalent.
2. Inscribe the following identification on the cover: the words "MAINTENANCE AND OPERATION MANUAL," the name and location of the system, material, equipment, building, name of Contractor, and

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- contract name and number. Include in the manual the names, addresses, and telephone numbers of each subcontractor installing the system or equipment and the local representatives for the material or equipment.
3. Provide a table of contents and assemble the manual to conform to the table of contents, with tab sheets placed before instructions covering the subject. The instructions shall be legible and easily read, with large sheets of drawings folded in.
  4. The manuals shall include:
    - a. Internal and interconnecting wiring and control diagrams with data to explain detailed operation and control of the equipment.
    - b. A control sequence describing start-up, operation, and shutdown.
    - c. Description of the function of each principal item of equipment.
    - d. Installation instructions.
    - e. Safety precautions for operation and maintenance.
    - f. Diagrams and illustrations.
    - g. Periodic maintenance and testing procedures and frequencies, including replacement parts numbers.
    - h. Performance data.
    - i. Pictorial "exploded" parts list with part numbers. Emphasis shall be placed on the use of special tools and instruments. The list shall indicate sources of supply, recommended spare and replacement parts, and name of servicing organization.
    - j. List of factory approved or qualified permanent servicing organizations for equipment repair and periodic testing and maintenance, including addresses and factory certification qualifications.
- G. Approvals will be based on complete submission of shop drawings, manuals, test reports, certifications, and samples as applicable.
- H. After approval and prior to installation, furnish the Resident Engineer with one sample of each of the following:
1. A minimum 300 mm (12 inches) length of each type and size of wire and cable along with the tag from the coils or reels from which the sample was taken. The length of the sample shall be sufficient to show all markings provided by the manufacturer.
  2. Each type of conduit coupling, bushing, and termination fitting.
  3. Conduit hangers, clamps, and supports.

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4. Duct sealing compound.
5. Each type of receptacle, toggle switch, lighting control sensor, outlet box, manual motor starter, device wall plate, engraved nameplate, wire and cable splicing and terminating material, and branch circuit single pole molded case circuit breaker.

**1.13 SINGULAR NUMBER**

- A. Where any device or part of equipment is referred to in these specifications in the singular number (e.g., "the switch"), this reference shall be deemed to apply to as many such devices as are required to complete the installation as shown on the drawings.

**1.14 ACCEPTANCE CHECKS AND TESTS**

- A. The Contractor shall furnish the instruments, materials, and labor for tests.
- B. Where systems are comprised of components specified in more than one section of Division 26, the Contractor shall coordinate the installation, testing, and adjustment of all components between various manufacturer's representatives and technicians so that a complete, functional, and operational system is delivered to the Government.
- C. When test results indicate any defects, the Contractor shall repair or replace the defective materials or equipment, and repeat the tests. Repair, replacement, and retesting shall be accomplished at no additional cost to the Government.

**1.15 WARRANTY**

- A. All work performed and all equipment and material furnished under this Division shall be free from defects and shall remain so for a period of one year from the date of acceptance of the entire installation by the Contracting Officer for the Government.

**1.16 INSTRUCTION**

- A. Instruction to designated Government personnel shall be provided for the particular equipment or system as required in each associated technical specification section.
- B. Furnish the services of competent instructors to give full instruction in the adjustment, operation, and maintenance of the specified equipment and system, including pertinent safety requirements. Instructors shall be thoroughly familiar with all aspects of the installation, and shall be trained in operating theory as well as practical operation and maintenance procedures.

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C. A training schedule shall be developed and submitted by the Contractor and approved by the Resident Engineer at least 30 days prior to the planned training.

**PART 2 - PRODUCTS (NOT USED)**

**PART 3 - EXECUTION (NOT USED)**

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SECTION 26 05 19  
LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

- A. This section specifies the furnishing, installation, connection, and testing of the electrical conductors and cables for use in electrical systems rated 600 V and below, indicated as cable(s), conductor(s), wire, or wiring in this section.

**1.2 RELATED WORK**

- A. Section 07 84 00, FIRESTOPPING: Sealing around penetrations to maintain the integrity of fire-resistant rated construction.
- B. Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS: Requirements that apply to all sections of Division 26.
- C. Section 26 05 26, GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS: Requirements for personnel safety and to provide a low impedance path for possible ground fault currents.
- D. Section 26 05 33, RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS: Conduits for conductors and cables.

**1.3 QUALITY ASSURANCE**

- A. Refer to Paragraph, QUALIFICATIONS (PRODUCTS AND SERVICES), in Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS.

**1.4 FACTORY TESTS**

- A. Conductors and cables shall be thoroughly tested at the factory per NEMA to ensure that there are no electrical defects. Factory tests shall be certified.

**1.5 SUBMITTALS**

- A. Submit six copies of the following in accordance with Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS.
  - 1. Shop Drawings:
    - a. Submit sufficient information to demonstrate compliance with drawings and specifications.
    - b. Submit the following data for approval:
      - 1) Electrical ratings and insulation type for each conductor and cable.
      - 2) Splicing materials and pulling lubricant.

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2. Certifications: Two weeks prior to final inspection, submit the following.

- a. Certification by the manufacturer that the conductors and cables conform to the requirements of the drawings and specifications.
- b. Certification by the Contractor that the conductors and cables have been properly installed, adjusted, and tested.

**1.6 APPLICABLE PUBLICATIONS**

A. Publications listed below (including amendments, addenda, revisions, supplements and errata) form a part of this specification to the extent referenced. Publications are reference in the text by designation only.

B. American Society of Testing Material (ASTM):

D2301-10 .....Standard Specification for Vinyl Chloride  
Plastic Pressure-Sensitive Electrical  
Insulating Tape

D2304-10 .....Test Method for Thermal Endurance of Rigid  
Electrical Insulating Materials

D3005-10 .....Low-Temperature Resistant Vinyl Chloride  
Plastic Pressure-Sensitive Electrical  
Insulating Tape

C. National Electrical Manufacturers Association (NEMA):

WC 70-09 .....Power Cables Rated 2000 Volts or Less for the  
Distribution of Electrical Energy

D. National Fire Protection Association (NFPA):

70-11 .....National Electrical Code (NEC)

E. Underwriters Laboratories, Inc. (UL):

44-10 .....Thermoset-Insulated Wires and Cables

83-08 .....Thermoplastic-Insulated Wires and Cables

467-07 .....Grounding and Bonding Equipment

486A-486B-03 .....Wire Connectors

486C-04 .....Splicing Wire Connectors

486D-05 .....Sealed Wire Connector Systems

486E-09 .....Equipment Wiring Terminals for Use with  
Aluminum and/or Copper Conductors

493-07 .....Thermoplastic-Insulated Underground Feeder and  
Branch Circuit Cables

514B-04 .....Conduit, Tubing, and Cable Fittings

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**PART 2 - PRODUCTS**

**2.1 CONDUCTORS AND CABLES**

- A. Conductors and cables shall be in accordance with NEMA, UL, as specified herein, and as shown on the drawings.
- B. All conductors shall be copper.
- C. Single Conductor and Cable:
  - 1. No. 12 AWG: Minimum size, except where smaller sizes are specified herein or shown on the drawings.
  - 2. No. 8 AWG and larger: Stranded.
  - 3. No. 10 AWG and smaller: Solid; except shall be stranded for final connection to motors, transformers, and vibrating equipment.
  - 4. Insulation: THHN-THWN.

D. Color Code:

- 1. No. 10 AWG and smaller: Solid color insulation or solid color coating.
- 2. No. 8 AWG and larger: Color-coded using one of the following methods:
  - a. Solid color insulation or solid color coating.
  - b. Stripes, bands, or hash marks of color specified.
  - c. Color using 19 mm (0.75 inches) wide tape.
- 3. For modifications and additions to existing wiring systems, color coding shall conform to the existing wiring system.
- 4. Conductors shall be color-coded as follows:

208/120 V	Phase
Black	A
Red	B
Blue	C
White	Neutral

- 5. Lighting circuit "switch legs", and 3-way and 4-way switch "traveling wires," shall have color coding that is unique and distinct (e.g., pink and purple) from the color coding indicated above. The unique color codes shall be solid and in accordance with the NEC. Coordinate color coding in the field with the Resident Engineer.



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**2.2 SPLICES**

- A. Splices shall be in accordance with NEC and UL.
- B. Above Ground Splices for No. 10 AWG and Smaller:
  - 1. Solderless, screw-on, reusable pressure cable type, with integral insulation, approved for copper and aluminum conductors.
  - 2. The integral insulator shall have a skirt to completely cover the stripped conductors.
  - 3. The number, size, and combination of conductors used with the connector, as listed on the manufacturer's packaging, shall be strictly followed.
- C. Above Ground Splices for No. 8 AWG to No. 4/0 AWG:
  - 1. Compression, hex screw, or bolt clamp-type of high conductivity and corrosion-resistant material, listed for use with copper and aluminum conductors.
  - 2. Insulate with materials approved for the particular use, location, voltage, and temperature. Insulation level shall be not less than the insulation level of the conductors being joined.
  - 3. Splice and insulation shall be product of the same manufacturer.
  - 4. All bolts, nuts, and washers used with splices shall be steel.
- D. Above Ground Splices for 250 kcmil and Larger:
  - 1. Long barrel "butt-splice" or "sleeve" type compression connectors, with minimum of two compression indents per wire, listed for use with copper and aluminum conductors.
  - 2. Insulate with materials approved for the particular use, location, voltage, and temperature. Insulation level shall be not less than the insulation level of the conductors being joined.
  - 3. Splice and insulation shall be product of the same manufacturer.
- E. Plastic electrical insulating tape: Per ASTM D2304, flame-retardant, cold and weather resistant.

**2.3 CONNECTORS AND TERMINATIONS**

- A. Mechanical type of high conductivity and corrosion-resistant material, listed for use with copper and aluminum conductors.
- B. Long barrel compression type of high conductivity and corrosion-resistant material, with minimum of two compression indents per wire, listed for use with copper and aluminum conductors.
- C. All bolts, nuts, and washers used to connect connections and terminations to bus bars or other termination points shall be steel.

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**2.4 CONTROL WIRING**

- A. Unless otherwise specified elsewhere in these specifications, control wiring shall be as specified herein, except that the minimum size shall be not less than No. 14 AWG.
- B. Control wiring shall be sized such that the voltage drop under in-rush conditions does not adversely affect operation of the controls.

**2.5 WIRE LUBRICATING COMPOUND**

- A. Lubricating compound shall be suitable for the wire insulation and conduit, and shall not harden or become adhesive.

**PART 3 - EXECUTION**

**3.1 GENERAL**

- A. Install conductors in accordance with the NEC, as specified, and as shown on the drawings.
- B. Install all conductors in raceway systems.
- C. Splice conductors only in outlet boxes, junction boxes and pullboxes.
- D. Conductors of different systems (e.g., 120 V and 277 V) shall not be installed in the same raceway.
- E. Install cable supports for all vertical feeders in accordance with the NEC. Provide split wedge type which firmly clamps each individual cable and tightens due to cable weight.
- F. In panelboards, cabinets, wireways, switches, enclosures, and equipment assemblies, neatly form, train, and tie the conductors with non-metallic ties.
- G. For connections to motors, vibrating equipment, stranded conductors shall be used only from the last fixed point of connection to the motors, transformers, or vibrating equipment.
- H. Use expanding foam or non-hardening duct-seal to seal conduits entering a building, after installation of conductors.
- I. Conductor and Cable Pulling:
  - 1. Provide installation equipment that will prevent the cutting or abrasion of insulation during pulling. Use lubricants approved for the cable.
  - 2. Use nonmetallic pull ropes.
  - 3. Attach pull ropes by means of either woven basket grips or pulling eyes attached directly to the conductors.
  - 4. All conductors in a single conduit shall be pulled simultaneously.

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- 5. Do not exceed manufacturer's recommended maximum pulling tensions and sidewall pressure values.
- J. No more than three branch circuits shall be installed in any one conduit.
- K. When stripping stranded conductors, use a tool that does not damage the conductor or remove conductor strands.

**3.2 SPLICE AND TERMINATION INSTALLATION**

- A. Splices and terminations shall be mechanically and electrically secure, and tightened to manufacturer's published torque values using a torque screwdriver or wrench.
- B. Where the Government determines that unsatisfactory splices or terminations have been installed, replace the splices or terminations at no additional cost to the Government.

**3.3 CONDUCTOR IDENTIFICATION**

- A. When using colored tape to identify phase, neutral, and ground conductors larger than No. 8 AWG, apply tape in half-overlapping turns for a minimum of 75 mm (3 inches) from terminal points, and in junction boxes, and pullboxes. Apply the last two laps of tape with no tension to prevent possible unwinding. Where cable markings are covered by tape, apply tags to cable, stating size and insulation type.

**3.4 FEEDER CONDUCTOR IDENTIFICATION**

- A. In each interior pullbox, install brass tags on all feeder conductors to clearly designate their circuit identification and voltage. The tags shall be the embossed type, 40 mm (1-1/2 inches) in diameter and 40 mils thick. Attach tags with plastic ties.

**3.5 EXISTING CONDUCTORS**

- A. Unless specifically indicated on the plans, existing conductors shall not be reused.

**3.6 CONTROL WIRING INSTALLATION**

- A. Unless otherwise specified in other sections, install control wiring and connect to equipment to perform the required functions as specified or as shown on the drawings.
- B. Install a separate power supply circuit for each system, except where otherwise shown on the drawings.

**3.7 CONTROL WIRING IDENTIFICATION**

- A. Install a permanent wire marker on each wire at each termination.

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B. Identifying numbers and letters on the wire markers shall correspond to those on the wiring diagrams used for installing the systems.

C. Wire markers shall retain their markings after cleaning.

**3.8 ACCEPTANCE CHECKS AND TESTS**

A. Perform in accordance with the manufacturer's recommendations. In addition, include the following:

1. Visual Inspection and Tests: Inspect physical condition.

2. Electrical tests:

a. After installation but before connection to utilization devices, such as fixtures, motors, or appliances, test conductors phase-to-phase and phase-to-ground resistance with an insulation resistance tester. Existing conductors to be reused shall also be tested.

b. Applied voltage shall be 500 V DC for 300 V rated cable, and 1000 V DC for 600 V rated cable. Apply test for one minute or until reading is constant for 15 seconds, whichever is longer. Minimum insulation resistance values shall not be less than 25 megohms for 300 V rated cable and 100 megohms for 600 V rated cable.

c. Perform phase rotation test on all three-phase circuits.

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SECTION 26 05 26  
GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

- A. This section specifies the furnishing, installation, connection, and testing of grounding and bonding equipment, indicated as grounding equipment in this section.
- B. "Grounding electrode system" refers to grounding electrode conductors and all electrodes required or allowed by NEC, as well as made, supplementary.
- C. The terms "connect" and "bond" are used interchangeably in this section and have the same meaning.

**1.2 RELATED WORK**

- A. Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS:  
Requirements that apply to all sections of Division 26.
- B. Section 26 05 19, LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES:  
Low-voltage conductors.
- C. Section 26 05 33, RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS: Conduit and boxes.
- D. Section 26 24 16, PANELBOARDS: Low-voltage panelboards.

**1.3 QUALITY ASSURANCE**

- A. Refer to Paragraph, QUALIFICATIONS (PRODUCTS AND SERVICES), in Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS.

**1.4 SUBMITTALS**

- A. Submit six copies of the following in accordance with Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS.
  - 1. Shop Drawings:
    - a. Submit sufficient information to demonstrate compliance with drawings and specifications.
  - 2. Certifications:
    - a. Certification by the Contractor that the grounding equipment has been properly installed and tested.

**1.5 APPLICABLE PUBLICATIONS**

- A. Publications listed below (including amendments, addenda, revisions, supplements, and errata) form a part of this specification to the extent referenced. Publications are referenced in the text by designation only.

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B. American Society for Testing and Materials (ASTM):

B1-07 .....Standard Specification for Hard-Drawn Copper  
Wire

B3-07 .....Standard Specification for Soft or Annealed  
Copper Wire

B8-11 .....Standard Specification for Concentric-Lay-  
Stranded Copper Conductors, Hard, Medium-Hard,  
or Soft

C. Institute of Electrical and Electronics Engineers, Inc. (IEEE):

81-83 .....IEEE Guide for Measuring Earth Resistivity,  
Ground Impedance, and Earth Surface Potentials  
of a Ground System Part 1: Normal Measurements

D. National Fire Protection Association (NFPA):

70-11 .....National Electrical Code (NEC)

70E-12 .....National Electrical Safety Code

99-12 .....Health Care Facilities

E. Underwriters Laboratories, Inc. (UL):

44-10 .....Thermoset-Insulated Wires and Cables

83-08 .....Thermoplastic-Insulated Wires and Cables

467-07 .....Grounding and Bonding Equipment

**PART 2 - PRODUCTS**

**2.1 GROUNDING AND BONDING CONDUCTORS**

- A. Equipment grounding conductors shall be insulated stranded copper, except that sizes No. 10 AWG and smaller shall be solid copper. Insulation color shall be continuous green for all equipment grounding conductors, except that wire sizes No. 4 AWG and larger shall be identified per NEC.
- B. Bonding conductors shall be bare stranded copper, except that sizes No. 10 AWG and smaller shall be bare solid copper. Bonding conductors shall be stranded for final connection to motors, transformers, and vibrating equipment.
- C. Conductor sizes shall not be less than shown on the drawings, or not less than required by the NEC, whichever is greater.
- D. Insulation: THHN-THWN and XHHW-2.

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**2.2 GROUND CONNECTIONS**

**A. Above Grade:**

1. Bonding Jumpers: Listed for use with aluminum and copper conductors. For wire sizes No. 8 AWG and larger, use compression-type connectors. For wire sizes smaller than No. 8 AWG, use mechanical type lugs. Connectors or lugs shall use steel bolts, nuts, and washers. Bolts shall be torqued to the values recommended by the manufacturer.
2. Connection to Building Steel: Exothermic-welded type connectors.
3. Connection to Grounding Bus Bars: Listed for use with aluminum and copper conductors. Use mechanical type lugs, with steel bolts, nuts, and washers. Bolts shall be torqued to the values recommended by the manufacturer.
4. Connection to Equipment Rack and Cabinet Ground Bars: Listed for use with aluminum and copper conductors. Use mechanical type lugs, with steel bolts, nuts, and washers. Bolts shall be torqued to the values recommended by the manufacturer.

**PART 3 - EXECUTION**

**3.1 GENERAL**

- A. Install grounding equipment in accordance with the NEC, as shown on the drawings, and as specified herein.
- B. Equipment Grounding: Metallic piping, building structural steel, electrical enclosures, raceways, junction boxes, outlet boxes, cabinets, machine frames, and other conductive items in close proximity with electrical circuits, shall be bonded and grounded.
- C. For patient care area electrical power system grounding, conform to NFPA 99 and NEC.

**3.2 INACCESSIBLE GROUNDING CONNECTIONS**

- A. Make grounding connections, which are normally buried or otherwise inaccessible, by exothermic weld.

**3.3 SECONDARY VOLTAGE EQUIPMENT AND CIRCUITS**

- A. Panelboards, and other electrical equipment:
  1. Connect the equipment grounding conductors to the ground bus.
  2. Connect metallic conduits by grounding bushings and equipment grounding conductor to the equipment ground bus.



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**3.4 RACEWAY**

**A. Conduit Systems:**

1. Ground all metallic conduit systems. All metallic conduit systems shall contain an equipment grounding conductor.
2. Metallic conduit that only contains a grounding conductor, and is provided for its mechanical protection, shall be bonded to that conductor at the entrance and exit from the conduit.
3. Metallic conduits which terminate without mechanical connection to an electrical equipment housing by means of locknut and bushings or adapters, shall be provided with grounding bushings. Connect bushings with a equipment grounding conductor to the equipment ground bus.

**B. Feeders and Branch Circuits:** Install equipment grounding conductors with all feeders, and power and lighting branch circuits.

**C. Boxes, Cabinets, Enclosures, and Panelboards:**

1. Bond the equipment grounding conductor to each pullbox, junction box, outlet box, device box, cabinets, and other enclosures through which the conductor passes (except for special grounding systems for intensive care units and other critical units shown).
2. Provide lugs in each box and enclosure for equipment grounding conductor termination.

**D. Wireway Systems:**

1. Bond the metallic structures of wireway to provide electrical continuity throughout the wireway system, by connecting a No. 6 AWG bonding jumper at all intermediate metallic enclosures and across all section junctions.
2. Install insulated No. 6 AWG bonding jumpers between the wireway system, bonded as required above, and the closest building ground at each end and approximately every 16 M (50 feet).
3. Use insulated No. 6 AWG bonding jumpers to ground or bond metallic wireway at each end for all intermediate metallic enclosures and across all section junctions.
4. Use insulated No. 6 AWG bonding jumpers to ground cable tray to column-mounted building ground plates (pads) at each end and approximately every 15 M (49 feet).

**E. Receptacles shall not be grounded through their mounting screws. Ground receptacles with a jumper from the receptacle green ground terminal to**

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the device box ground screw and a jumper to the branch circuit equipment grounding conductor.

- F. Ground lighting fixtures to the equipment grounding conductor of the wiring system. Fixtures connected with flexible conduit shall have a green ground wire included with the power wires from the fixture through the flexible conduit to the first outlet box.
- G. Fixed electrical appliances and equipment shall be provided with a ground lug for termination of the equipment grounding conductor.

**3.5 CORROSION INHIBITORS**

- A. When making grounding and bonding connections, apply a corrosion inhibitor to all contact surfaces. Use corrosion inhibitor appropriate for protecting a connection between the metals used.

**3.6 CONDUCTIVE PIPING**

- A. Bond all conductive piping systems, interior and exterior, to the grounding electrode system. Bonding connections shall be made as close as practical to the equipment ground bus.

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SECTION 26 05 33  
RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

- A. This section specifies the furnishing, installation, and connection of conduit, fittings, and boxes, to form complete, coordinated, grounded raceway systems. Raceways are required for all wiring unless shown or specified otherwise.
- B. Definitions: The term conduit, as used in this specification, shall mean any or all of the raceway types specified.

**1.2 RELATED WORK**

- A. Section 06 10 00, ROUGH CARPENTRY: Mounting board for telephone closets.
- B. Section 07 84 00, FIRESTOPPING: Sealing around penetrations to maintain the integrity of fire rated construction.
- C. Section 07 92 00, JOINT SEALANTS: Sealing around conduit penetrations through the building envelope to prevent moisture migration into the building.
- D. Section 09 91 00, PAINTING: Identification and painting of conduit and other devices.
- E. Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS: General electrical requirements and items that are common to more than one section of Division 26.
- F. Section 26 05 26, GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS: Requirements for personnel safety and to provide a low impedance path for possible ground fault currents.

**1.3 QUALITY ASSURANCE**

Refer to Paragraph, QUALIFICATIONS, in Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS.

**1.4 SUBMITTALS**

In accordance with Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS, submit the following:

- A. Manufacturer's Literature and Data: Showing each cable type and rating. The specific item proposed and its area of application shall be identified on the catalog cuts.
- B. Shop Drawings:
  - 1. Size and location of main feeders.
  - 2. Size and location of panels and pull-boxes.
  - 3. Layout of required conduit penetrations through structural elements.

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**C. Certifications:**

1. Two weeks prior to the final inspection, submit four copies of the following certifications to the Resident Engineer:
  - a. Certification by the manufacturer that the material conforms to the requirements of the drawings and specifications.
  - b. Certification by the contractor that the material has been properly installed.

**1.5 APPLICABLE PUBLICATIONS**

- A. Publications listed below (including amendments, addenda, revisions, supplements, and errata) form a part of this specification to the extent referenced. Publications are referenced in the text by designation only.
- B. American National Standards Institute (ANSI):
  - C80.1-05 .....Electrical Rigid Steel Conduit
  - C80.3-05 .....Steel Electrical Metal Tubing
  - C80.6-05 .....Electrical Intermediate Metal Conduit
- C. National Fire Protection Association (NFPA):
  - 70-08 .....National Electrical Code (NEC)
- D. Underwriters Laboratories, Inc. (UL):
  - 1-05 .....Flexible Metal Conduit
  - 5-04 .....Surface Metal Raceway and Fittings
  - 6-07 .....Electrical Rigid Metal Conduit - Steel
  - 50-95 .....Enclosures for Electrical Equipment
  - 360-093 .....Liquid-Tight Flexible Steel Conduit
  - 467-07 .....Grounding and Bonding Equipment
  - 514A-04 .....Metallic Outlet Boxes
  - 514B-04 .....Conduit, Tubing, and Cable Fittings
  - 797-07 .....Electrical Metallic Tubing
  - 1242-06 .....Electrical Intermediate Metal Conduit - Steel
- E. National Electrical Manufacturers Association (NEMA):
  - FB1-07 .....Fittings, Cast Metal Boxes and Conduit Bodies  
for Conduit, Electrical Metallic Tubing and  
Cable

**PART 2 - PRODUCTS**

**2.1 MATERIAL**

- A. Conduit Size: In accordance with the NEC, but not less than 3/4-inch minimum unless otherwise shown, including flexible conduit for tap connections to recessed lighting fixtures.

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**B. Conduit:**

1. Rigid steel: Shall conform to UL 6 and ANSI C80.1.
2. Rigid intermediate steel conduit (IMC): Shall conform to UL 1242 and ANSI C80.6.
3. Electrical metallic tubing (EMT): Shall conform to UL 797 and ANSI C80.3. Maximum size not to exceed 4 in [105 mm] and shall be permitted only with cable rated 600 V or less.
4. Flexible galvanized steel conduit: Shall conform to UL 1.
5. Liquid-tight flexible metal conduit: Shall conform to UL 360.

**C. Conduit Fittings:**

1. Rigid steel and IMC conduit fittings:
  - a. Fittings shall meet the requirements of UL 514B and NEMA FB1.
  - b. Standard threaded couplings, locknuts, bushings, conduit bodies, and elbows: Only steel or malleable iron materials are acceptable. Integral retractable type IMC couplings are also acceptable.
  - c. Locknuts: Bonding type with sharp edges for digging into the metal wall of an enclosure.
  - d. Bushings: Metallic insulating type, consisting of an insulating insert, molded or locked into the metallic body of the fitting. Bushings made entirely of metal or nonmetallic material are not permitted.
  - e. Erickson (union-type) and set screw type couplings: Approved for use in concrete are permitted for use to complete a conduit run where conduit is installed in concrete. Use set screws of case-hardened steel with hex head and cup point to firmly seat in conduit wall for positive ground. Tightening of set screws with pliers is prohibited.
  - f. Sealing fittings: Threaded cast iron type. Use continuous drain-type sealing fittings to prevent passage of water vapor. In concealed work, install fittings in flush steel boxes with blank cover plates having the same finishes as that of other electrical plates in the room.
2. Electrical metallic tubing fittings:
  - a. Fittings and conduit bodies shall meet the requirements of UL 514B, ANSI C80.3, and NEMA FB1.
  - b. Only steel or malleable iron materials are acceptable.
  - c. Setscrew couplings and connectors: Use setscrews of case-hardened steel with hex head and cup point, to firmly seat in wall of conduit for positive grounding.
  - d. Indent-type connectors or couplings are prohibited.

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- e. Die-cast or pressure-cast zinc-alloy fittings or fittings made of "pot metal" are prohibited.
- 3. Flexible steel conduit fittings:
  - a. Conform to UL 514B. Only steel or malleable iron materials are acceptable.
  - b. Clamp-type, with insulated throat.
- 4. Liquid-tight flexible metal conduit fittings:
  - a. Fittings shall meet the requirements of UL 514B and NEMA FB1.
  - b. Only steel or malleable iron materials are acceptable.
  - c. Fittings must incorporate a threaded grounding cone, a steel or plastic compression ring, and a gland for tightening. Connectors shall have insulated throats.
- 5. Expansion and deflection couplings:
  - a. Conform to UL 467 and UL 514B.
  - b. Accommodate a 0.75 in [19 mm] deflection, expansion, or contraction in any direction, and allow 30 degree angular deflections.
  - c. Include internal flexible metal braid, sized to guarantee conduit ground continuity and a low-impedance path for fault currents, in accordance with UL 467 and the NEC tables for equipment grounding conductors.
  - d. Jacket: Flexible, corrosion-resistant, watertight, moisture and heat-resistant molded rubber material with stainless steel jacket clamps.
- D. Conduit Supports:
  - 1. Parts and hardware: Zinc-coat or provide equivalent corrosion protection.
  - 2. Individual Conduit Hangers: Designed for the purpose, having a pre-assembled closure bolt and nut, and provisions for receiving a hanger rod.
  - 3. Multiple conduit (trapeze) hangers: Not less than 1.5 x 1.5 in [38 mm x 38 mm], 12-gauge steel, cold-formed, lipped channels; with not less than 0.375 in [9 mm] diameter steel hanger rods.
  - 4. Solid Masonry and Concrete Anchors: Self-drilling expansion shields, or machine bolt expansion.
- E. Outlet, Junction, and Pull Boxes:
  - 1. UL-50 and UL-514A.
  - 2. Cast metal where required by the NEC or shown, and equipped with rustproof boxes.
  - 3. Sheet metal boxes: Galvanized steel, except where otherwise shown.

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4. Flush-mounted wall or ceiling boxes shall be installed with raised covers so that the front face of raised cover is flush with the wall. Surface-mounted wall or ceiling boxes shall be installed with surface-style flat or raised covers.

- F. Wireways: Equip with hinged covers, except where removable covers are shown. Include couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other fittings to match and mate with wireways as required for a complete system.

**PART 3 - EXECUTION**

**3.1 PENETRATIONS**

- A. Cutting or Holes:
  1. Cut holes in advance where they should be placed in the structural elements, such as ribs or beams. Obtain the approval of the Resident Engineer prior to drilling through structural elements.
  2. Cut holes through concrete and masonry in new and existing structures with a diamond core drill or concrete saw. Pneumatic hammers, impact electric, hand, or manual hammer-type drills are not allowed, except where permitted by the Resident Engineer as required by limited working space.
- B. Firestop: Where conduits, wireways, and other electrical raceways pass through fire partitions, fire walls, smoke partitions, or floors, install a fire stop that provides an effective barrier against the spread of fire, smoke and gases as specified in Section 07 84 00, FIRESTOPPING.
- C. Waterproofing: At floor, exterior wall, and roof conduit penetrations, completely seal clearances around the conduit and make watertight, as specified in Section 07 92 00, JOINT SEALANTS.

**3.2 INSTALLATION, GENERAL**

- A. In accordance with UL, NEC, as shown, and as specified herein.
- B. Essential (Emergency) raceway systems shall be entirely independent of other raceway systems, except where shown on drawings.
- C. Install conduit as follows:
  1. In complete mechanically and electrically continuous runs before pulling in cables or wires.
  2. Unless otherwise indicated on the drawings or specified herein, installation of all conduits shall be concealed within finished walls, floors, and ceilings.
  3. Flattened, dented, or deformed conduit is not permitted. Remove and replace the damaged conduits with new undamaged material.



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4. Assure conduit installation does not encroach into the ceiling height head room, walkways, or doorways.
  5. Cut square, ream, remove burrs, and draw up tight.
  6. Independently support conduit at 8 ft [2.4 M] on centers. Do not use other supports, i.e., suspended ceilings, suspended ceiling supporting members, lighting fixtures, conduits, mechanical piping, or mechanical ducts.
  7. Support within 12 in [300 mm] of changes of direction, and within 12 in [300 mm] of each enclosure to which connected.
  8. Close ends of empty conduit with plugs or caps at the rough-in stage until wires are pulled in, to prevent entry of debris.
  9. Conduit installations under fume and vent hoods are prohibited.
  10. Secure conduits to cabinets, junction boxes, pull-boxes, and outlet boxes with bonding type locknuts. For rigid and IMC conduit installations, provide a locknut on the inside of the enclosure, made up wrench tight. Do not make conduit connections to junction box covers.
  11. Conduit bodies shall only be used for changes in direction, and shall not contain splices.
- D. Conduit Bends:
1. Make bends with standard conduit bending machines.
  2. Conduit hickey may be used for slight offsets and for straightening stubbed out conduits.
  3. Bending of conduits with a pipe tee or vise is prohibited.
- E. Layout and Homeruns:
1. Install conduit with wiring, including homeruns, as shown on drawings.
  2. Deviations: Make only where necessary to avoid interferences and only after drawings showing the proposed deviations have been submitted approved by the Resident Engineer.

**3.3 CONCEALED WORK INSTALLATION**

- A. Above Furred or Suspended Ceilings and in Walls:
1. Conduit for conductors 600 V and below: Rigid steel, IMC, or EMT. Mixing different types of conduits indiscriminately in the same system is prohibited.
  2. Align and run conduit parallel or perpendicular to the building lines.
  3. Connect recessed lighting fixtures to conduit runs with maximum 6 ft [1.8 M] of flexible metal conduit extending from a junction box to the fixture.

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4. Tightening setscrews with pliers is prohibited.

**3.4 EXPOSED WORK INSTALLATION**

- A. Unless otherwise indicated on the drawings, exposed conduit is only permitted in electrical rooms.
- B. Conduit for Conductors 600 V and Below: Rigid steel, IMC, or EMT. Mixing different types of conduits indiscriminately in the system is prohibited.
- C. Align and run conduit parallel or perpendicular to the building lines.
- D. Install horizontal runs close to the ceiling or beams and secure with conduit straps.
- E. Support horizontal or vertical runs at not over 8 ft [2.4 M] intervals.
- F. Painting:
  - 1. Paint exposed conduit as specified in Section 09 91 00, PAINTING.
  - 2. Paint all conduits containing cables rated over 600 V safety orange. Refer to Section 09 91 00, PAINTING for preparation, paint type, and exact color. In addition, paint legends, using 2 in [50 mm] high black numerals and letters, showing the cable voltage rating. Provide legends where conduits pass through walls and floors and at maximum 20 ft [6 M] intervals in between.

**3.5 WET OR DAMP LOCATIONS**

- A. Unless otherwise shown, use conduits of rigid steel or IMC.
- B. Provide sealing fittings to prevent passage of water vapor where conduits pass from warm to cold locations, i.e., refrigerated spaces, constant-temperature rooms, air-conditioned spaces, building exterior walls, roofs, or similar spaces.
- C. Unless otherwise shown, use rigid steel or IMC conduit within 5 ft [1.5 M] of the exterior. Conduit shall be half-lapped with 10 mil PVC tape before installation. After installation, completely recoat or retape any damaged areas of coating.

**3.6 MOTORS AND VIBRATING EQUIPMENT**

- A. Use flexible metal conduit for connections to motors and other electrical equipment subject to movement, vibration, misalignment, cramped quarters, or noise transmission.
- B. Use liquid-tight flexible metal conduit for installation in moisture or humidity laden atmosphere, inside airstream of HVAC units, and locations subject to seepage or dripping of oil, grease, or water. Provide a green equipment grounding conductor with flexible metal conduit.

**3.7 EXPANSION JOINTS**

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- A. Conduits 3 in [75 mm] and larger that are secured to the building structure on opposite sides of a building expansion joint require expansion and deflection couplings. Install the couplings in accordance with the manufacturer's recommendations.
- B. Provide conduits smaller than 3 in [75 mm] with junction boxes on both sides of the expansion joint. Connect conduits to junction boxes with sufficient slack of flexible conduit to produce 5 in [125 mm] vertical drop midway between the ends. Flexible conduit shall have a bonding jumper installed. In lieu of this flexible conduit, expansion and deflection couplings as specified above for conduits 15 in [375 mm] and larger are acceptable.
- C. Install expansion and deflection couplings where shown.

**3.8 CONDUIT SUPPORTS, INSTALLATION**

- A. Safe working load shall not exceed one-quarter of proof test load of fastening devices.
- B. Use pipe straps or individual conduit hangers for supporting individual conduits.
- C. Support multiple conduit runs with trapeze hangers. Use trapeze hangers that are designed to support a load equal to or greater than the sum of the weights of the conduits, wires, hanger itself, and 200 lbs [90 kg]. Attach each conduit with U-bolts or other approved fasteners.
- D. Support conduit independently of junction boxes, pull-boxes, fixtures, suspended ceiling T-bars, angle supports, and similar items.
- E. Fasteners and Supports in Solid Masonry and Concrete:
  - 1. New Construction: Use steel or malleable iron concrete inserts set in place prior to placing the concrete.
  - 2. Existing Construction:
    - a. Steel expansion anchors not less than 0.25 in [6 mm] bolt size and not less than 1.125 in [28 mm] embedment.
    - b. Power set fasteners not less than 0.25 in [6 mm] diameter with depth of penetration not less than 3 in [75 mm].
    - c. Use vibration and shock-resistant anchors and fasteners for attaching to concrete ceilings.
- F. Hollow Masonry: Toggle bolts.
- G. Bolts supported only by plaster or gypsum wallboard are not acceptable.
- H. Metal Structures: Use machine screw fasteners or other devices specifically designed and approved for the application.
- I. Attachment by wood plugs, rawl plug, plastic, lead or soft metal anchors, or wood blocking and bolts supported only by plaster is prohibited.

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- J. Chain, wire, or perforated strap shall not be used to support or fasten conduit.
- K. Spring steel type supports or fasteners are prohibited for all uses except horizontal and vertical supports/fasteners within walls.
- L. Vertical Supports: Vertical conduit runs shall have riser clamps and supports in accordance with the NEC and as shown. Provide supports for cable and wire with fittings that include internal wedges and retaining collars.

**3.9 BOX INSTALLATION**

- A. Boxes for Concealed Conduits:
  - 1. Flush-mounted.
  - 2. Provide raised covers for boxes to suit the wall or ceiling, construction, and finish.
- B. In addition to boxes shown, install additional boxes where needed to prevent damage to cables and wires during pulling-in operations.
- C. Remove only knockouts as required and plug unused openings. Use threaded plugs for cast metal boxes and snap-in metal covers for sheet metal boxes.
- D. Outlet boxes mounted back-to-back in the same wall are prohibited. A minimum 24 in [600 mm] center-to-center lateral spacing shall be maintained between boxes.
- E. Minimum size of outlet boxes for ground fault interrupter (GFI) receptacles is 4 in [100 mm] square x 2.125 in [55 mm] deep, with device covers for the wall material and thickness involved.
- F. Stencil or install phenolic nameplates on covers of the boxes identified on riser diagrams; for example "SIG-FA JB No. 1."
- G. On all branch circuit junction box covers, identify the circuits with black marker.

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**SECTION 26 09 23**  
**LIGHTING CONTROLS**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

This section specifies the furnishing, installation and connection of the lighting controls.

**1.2 RELATED WORK**

- A. Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS: General requirements that are common to more than one section of Division 26.
- B. Section 26 05 21, LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES (600 VOLTS AND BELOW): Cables and wiring.
- C. Section 26 05 26, GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS: Requirements for personnel safety and to provide a low impedance path to ground for possible ground fault currents.
- D. Section 24 26 16, PANELBOARDS: panelboard enclosure and interior bussing used for lighting control panels.
- E. Section 26 27 26, WIRING DEVICES: Wiring devices used for control of the lighting systems.

**1.3 QUALITY ASSURANCE**

Refer to Paragraph, QUALIFICATIONS, in Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS.

**1.4 SUBMITTALS**

- A. In accordance with Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS, submit the following:
- B. Product Data: For each type of lighting control, submit the following information.
  - 1. Manufacturer's catalog data.
  - 2. Wiring schematic and connection diagram.
  - 3. Installation details.
  - 4. Load schedule indicating actual connected load, load type, and voltage per circuit, circuits and their respective control zones, circuits that are on emergency, and capacity, phase, and corresponding circuit numbers.
- C. Manuals:
  - 1. Submit, simultaneously with the shop drawings companion copies of complete maintenance and operating manuals including technical data sheets, and information for ordering replacement parts.
  - 2. Two weeks prior to the final inspection, submit four copies of the final updated maintenance and operating manuals, including any changes, to the Resident Engineer.

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**D. Certifications:**

1. Two weeks prior to final inspection, submit four copies of the following certifications to the Resident Engineer:
  - a. Certification by the Contractor that the equipment has been properly installed, adjusted, and tested.

**1.5 APPLICABLE PUBLICATIONS**

- A. Publications listed below (including amendments, addenda, revisions, supplements, and errata) form a part of this specification to the extent referenced. Publications are referenced in the text by designation only.
- B. Green Seal (GS):  
GC-12 .....Occupancy Sensors
- C. Illuminating Engineering Society of North America (IESNA):  
IESNA LM-48 ..... Guide for Calibration of Photoelectric Control Devices
- D. National Electrical Manufacturer's Association (NEMA)  
C136.10 .....American National Standard for Roadway Lighting Equipment-Locking-Type Photocontrol Devices and Mating Receptacles - Physical and Electrical Interchangeability and Testing  
ICS-1 .....Standard for Industrial Control and Systems General Requirements  
ICS-2..... Standard for Industrial Control and Systems: Controllers, Contractors, and Overload Relays Rated Not More than 2000 Volts AC or 750 Volts DC: Part 8 - Disconnect Devices for Use in Industrial Control Equipment  
ICS-6 .....Standard for Industrial Controls and Systems Enclosures
- E. Underwriters Laboratories, Inc. (UL):  
20 .....Standard for General-Use Snap Switches  
773 .....Standard for Plug-In Locking Type Photocontrols for Use with Area Lighting  
773A .....Nonindustrial Photoelectric Switches for Lighting Control  
98 .....Enclosed and Dead-Front Switches  
917.....Clock Operated Switches

**PART 2 - PRODUCTS**

**2.1 WALL STATIONS**

- A. Line Voltage Control Unit:
  1. Preset lighting control with zone override:

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- a. Intensity for each zone indicated by means of one illuminated bar graph per zone.
  - b. Each zone and scene to be field customizable to indicate each zone and scene name.
  - c. Astronomical time clock and programmer interface.
    - 1) Provide access to:
      - a) Scene selections.
      - b) Fade zone to a level.
      - c) Fine-tuning of preset levels with scene raise/lower.
      - d) Lock out scenes and zones.
      - e) Fine-tuning of light levels with individual zone raise/lower.
      - f) Terminal block for wired infrared signal input.
      - g) Enable/disable wall station.
  - d. Light intensity with real time energy savings by digital display.
  - e. Fade time indicated by digital display for current scene while fading.
  - f. Incorporate built-in wide angle infrared receiver.
  - g. For temporary local overrides, individual raise/lower buttons to allow zones to be adjusted without altering scene values stored in memory.
2. Color:
- a. White.
  - b. Color variation in same product family: Maximum  $\Delta E = 1$ , CIE  $L^*a^*b$  color units.
  - c. Visible Parts: Exhibit ultraviolet color stability when tested with multiple actinic light sources as defined in ASTM D4674.  
Provide proof of testing upon request.
- B. Provide faceplates with concealed mounting hardware.
- C. Engrave wall stations in English with appropriate button, zone, and scene engraving descriptions furnished prior to fabrication.
- D. Silk-screened borders, logos, and graduations to use graphic process that chemically bonds graphics to faceplate, resistant to removal by scratching and cleaning.

**2.2 TIMER SWITCHES**

- A. Digital switches with backlit LCD display, 120/277 volt rated, fitting as a replacement for standard wall switches.
  - 1. Compatibility: Compatible with all ballasts.
  - 2. Warning: Audible warning to sound during the last minute of "on" operation.

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3. Time-out: Adjustable from 5 minutes to 12 hours.
4. Faceplate: Refer to wall plate material and color requirements for toggle switches, as specified in Section 26 27 26, WIRING DEVICES.

**2.3 INDOOR OCCUPANCY SENSORS**

- A. Wall- or ceiling-mounting, solid-state units with a power supply and relay unit, suitable for the environmental conditions in which installed.
  1. Operation: Unless otherwise indicated, turn lights on when covered area is occupied and off when unoccupied; with a 1 to 15 minute adjustable time delay for turning lights off.
  2. Sensor Output: Contacts rated to operate the connected relay. Sensor shall be powered from the relay unit.
  3. Relay Unit: Dry contacts rated for 20A ballast load at 120V and 277V, for 13A tungsten at 120V, and for 1 hp at 120V.
  4. Mounting:
    - a. Sensor: Suitable for mounting in any position on a standard outlet box.
    - b. Time-Delay and Sensitivity Adjustments: Recessed and concealed behind hinged door.
  5. Indicator: LED, to show when motion is being detected during testing and normal operation of the sensor.
  6. Bypass Switch: Override the on function in case of sensor failure.
  7. Manual/automatic selector switch.
  8. Automatic Light-Level Sensor: Adjustable from 2 to 200 fc [21.5 to 2152 lx]; keep lighting off when selected lighting level is present.
  9. Faceplate for Wall-Switch Replacement Type: Refer to wall plate material and color requirements for toggle switches, as specified in Section 26 27 26, WIRING DEVICES.
- B. Dual-technology Type: Ceiling mounting; combination PIR and ultrasonic detection methods, field-selectable.
  1. Sensitivity Adjustment: Separate for each sensing technology.
  2. Detector Sensitivity: Detect occurrences of 6-inch [150mm] minimum movement of any portion of a human body that presents a target of not less than 36 sq. in. [232 sq. cm], and detect a person of average size and weight moving not less than 12 inches [305 mm] in either a horizontal or a vertical manner at an approximate speed of 12 inches/s [305 mm/s].
  3. Detection Coverage: as scheduled on drawings.

**2.4 LIGHTING CONTROL MODULE**

- A. Lighting Control Module:



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1. Mechanical:
  - a. Listed to UL 508 (United States) as industrial control equipment.
  - b. Delivered and installed as a UL listed factory assembled panel.
  - c. Panels passively cooled via free-convection, unaided by fans or other means.
2. Surface mounted.
3. Switching:
  - a. Rated life of relay: Minimum 1,000,000 cycles.
  - b. Load switched in manner that prevents arcing at mechanical contacts when power is applied to and removed from load circuits.
  - c. Fully rated output continuous duty for inductive, capacitive, and resistive loads.
  - d. Module to integrate up to 4 individually controlled zones, each with a capacity of up to 16 amps, of high in-rush lighting load (magnetic fluorescent ballast, electronic fluorescent ballast, HID, incandescent, magnetic low-voltage, electronic low-voltage, neon/cold cathode and motor loads).
4. Connection without interface to wired:
  - a. Occupancy sensors.
  - b. IR receivers for personal control.
5. Connects to Lighting Management Panel via RS485.
6. LED status indicators confirm communication with occupancy sensors, daylight sensors, and IR receivers.
7. Thermal protection reports to Light Management System if module overheats.
8. Contact Closure Input:
  - a. Directly accept contact closure input from a dry contact closure or solid-state output without interface to:
    - 1) Activate scenes.
    - 2) Enable to disable timeclock.
9. Emergency Contact Closure Input:
  - a. Turn all zones to full output during emergency state via direct contact closure input from UL 924 Listed Emergency Lighting Interface, security system or fire alarm system.
  - b. Allow configurable zone response during emergency state.
  - c. Disable control operation until emergency signal is cleared.

**PART 3 - EXECUTION**

**3.1 INSTALLATION**

- A. Installation shall be in accordance with the NEC, manufacturer's instructions and as shown on the drawings or specified.

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- B. Aiming for wall-mounted and ceiling-mounted motion sensor switches shall be per manufacturer's recommendations.
- C. Set occupancy sensor "on" duration to 15 minutes.
- D. Locate light level sensors as indicated and in accordance with the manufacturer's recommendations. Adjust sensor for the scheduled light level at the typical work plane for that area.
- E. Label time switches and contactors with a unique designation.

**3.2 ACCEPTANCE CHECKS AND TESTS**

- A. Perform in accordance with the manufacturer's recommendations.
- B. Upon completion of installation, conduct an operating test to show that equipment operates in accordance with requirements of this section.
- C. Test for full range of dimming ballast and dimming controls capability. Observe for visually detectable flicker over full dimming range.
- D. Test occupancy sensors for proper operation. Observe for light control over entire area being covered.
- E. Program lighting control panels per schedule on drawings.
- F. Upon completion of the installation, the system shall be commissioned by the manufacturer's factory-authorized technician who will verify all adjustments and sensor placements.

**3.3 FOLLOW-UP VERIFICATION**

Upon completion of acceptance checks and tests, the Contractor shall show by demonstration in service that the lighting control devices are in good operating condition and properly performing the intended function.

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SECTION 26 24 16  
PANELBOARDS

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

- A. This section specifies the furnishing, installation, and connection of panelboards.

**1.2 RELATED WORK**

- A. Section 09 91 00, PAINTING: Painting of panelboards.
- B. Section 13 05 41, SEISMIC RESTRAINT REQUIREMENTS FOR NON-STRUCTURAL COMPONENTS: Requirements for seismic restraint of non-structural components.
- C. Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS: Requirements that apply to all sections of Division 26.
- D. Section 26 05 19, LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES: Low-voltage conductors.
- E. Section 26 05 26, GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS: Requirements for personnel safety and to provide a low impedance path for possible ground fault currents.
- F. Section 26 05 33, RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS: Conduits.
- G. Section 26 09 23, LIGHTING CONTROLS: Lighting controls integral to panelboards.

**1.3 QUALITY ASSURANCE**

- A. Refer to Paragraph, QUALIFICATIONS (PRODUCTS AND SERVICES), in Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS.

**1.4 SUBMITTALS**

- A. Submit six copies of the following in accordance with Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS.
  - 1. Shop Drawings:
    - a. Submit sufficient information to demonstrate compliance with drawings and specifications.
    - b. Include electrical ratings, dimensions, mounting details, materials, required clearances, terminations, weight, circuit breakers, wiring and connection diagrams, accessories, and nameplate data.
    - c. Certification from the manufacturer that a representative panelboard has been seismically tested to International Building Code requirements in accordance with Section 13 05 41, SEISMIC

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RESTRAINT REQUIREMENTS FOR NON-STRUCTURAL COMPONENTS.

Certification shall be based upon simulated seismic forces on a shake table or by analytical methods, but not by experience data or other methods.

2. Manuals:

- a. Submit, simultaneously with the shop drawings, complete maintenance and operating manuals including technical data sheets, wiring diagrams, and information for ordering circuit breakers and replacement parts.

- 1) Include schematic diagrams, with all terminals identified, matching terminal identification in the panelboards.
- 2) Include information for testing, repair, troubleshooting, assembly, and disassembly.

- b. If changes have been made to the maintenance and operating manuals originally submitted, submit updated maintenance and operating manuals two weeks prior to the final inspection.

3. Certifications: Two weeks prior to final inspection, submit the following.

- a. Certification by the manufacturer that the panelboards conform to the requirements of the drawings and specifications.
- b. Certification by the Contractor that the panelboards have been properly installed, adjusted, and tested.

**1.5 APPLICABLE PUBLICATIONS**

- A. Publications listed below (including amendments, addenda, revisions, supplements, and errata) form a part of this specification to the extent referenced. Publications are referenced in the text by designation only.

B. International Code Council (ICC):

IBC-12 .....International Building Code

C. National Electrical Manufacturers Association (NEMA):

PB 1-11 .....Panelboards

250-08 .....Enclosures for Electrical Equipment (1,000V  
Maximum)

D. National Fire Protection Association (NFPA):

70-11 .....National Electrical Code (NEC)

70E-12 .....Standard for Electrical Safety in the Workplace

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E. Underwriters Laboratories, Inc. (UL):

50-95 .....Enclosures for Electrical Equipment

67-09 .....Panelboards

489-09 .....Molded Case Circuit Breakers and Circuit  
Breaker Enclosures

**PART 2 - PRODUCTS**

**2.1 GENERAL REQUIREMENTS**

- A. Panelboards shall be in accordance with NEC, NEMA, UL, as specified, and as shown on the drawings.
- B. Panelboards shall have main breaker or main lugs, bus size, voltage, phases, number of circuit breaker mounting spaces, top or bottom feed, flush or surface mounting, branch circuit breakers, and accessories as shown on the drawings.
- C. Panelboards shall be completely factory-assembled with molded case circuit breakers and integral accessories as shown on the drawings or specified herein.
- D. Non-reduced size copper bus bars, rigidly supported on molded insulators, and fabricated for bolt-on type circuit breakers.
- E. Bus bar connections to the branch circuit breakers shall be the "distributed phase" or "phase sequence" type.
- F. Mechanical lugs furnished with panelboards shall be cast, stamped, or machined metal alloys listed for use with the conductors to which they will be connected.
- G. Neutral bus shall be 100% rated, mounted on insulated supports.
- H. Grounding bus bar shall be equipped with screws or lugs for the connection of equipment grounding conductors.
- I. Bus bars shall be braced for the available short-circuit current as shown on the drawings, but not be less than 10,000 A symmetrical for 120/208 V panelboards.
- J. In two-section panelboards, the main bus in each section shall be full size. The first section shall be furnished with subfeed lugs on the line side of main lugs only, or through-feed lugs for main breaker type panelboards, and have field-installed cable connections to the second section as shown on the drawings. Panelboard sections with tapped bus or crossover bus are not acceptable.
- K. Series-rated panelboards are not permitted.

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**2.2 ENCLOSURES AND TRIMS**

**A. Enclosures:**

1. Provide galvanized steel enclosures, with NEMA rating as shown on the drawings or as required for the environmental conditions in which installed.
2. Enclosures shall not have ventilating openings.
3. Enclosures may be of one-piece formed steel or of formed sheet steel with end and side panels welded, riveted, or bolted as required.
4. Provide manufacturer's standard option for prepunched knockouts on top and bottom endwalls.
5. Include removable inner dead front cover, independent of the panelboard cover.

**B. Trims:**

1. Hinged "door-in-door" type.
2. Interior hinged door with hand-operated latch or latches, as required to provide access only to circuit breaker operating handles, not to energized parts.
3. Outer hinged door shall be securely mounted to the panelboard enclosure with factory bolts, screws, clips, or other fasteners, requiring a key or tool for entry. Hand-operated latches are not acceptable.
4. Inner and outer doors shall open left to right.
5. Trims shall be flush or surface type as shown on the drawings.

**2.3 MOLDED CASE CIRCUIT BREAKERS**

- A. Circuit breakers shall be per UL, NEC, as shown on the drawings, and as specified.
- B. Circuit breakers shall be bolt-on type.
- C. Circuit breakers shall have minimum interrupting rating as required to withstand the available fault current, but not less than:
1. 120/208 V Panelboard: 10,000 A symmetrical.
- D. Circuit breakers shall have automatic, trip free, non-adjustable, inverse time, and instantaneous magnetic trips for less than 400 A frame. Circuit breakers with 400 A frames and above shall have magnetic trip, adjustable from 5x to 10x. Breaker magnetic trip setting shall be set to maximum, unless otherwise noted.
- E. Circuit breaker features shall be as follows:
1. A rugged, integral housing of molded insulating material.

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2. Silver alloy contacts.
3. Arc quenchers and phase barriers for each pole.
4. Quick-make, quick-break, operating mechanisms.
5. A trip element for each pole, thermal magnetic type with long time delay and instantaneous characteristics, a common trip bar for all poles and a single operator.
6. Electrically and mechanically trip free.
7. An operating handle which indicates closed, tripped, and open positions.
8. An overload on one pole of a multi-pole breaker shall automatically cause all the poles of the breaker to open.
9. Lighting control breakers (including accessories to switch line currents), or other accessory devices or functions shall be provided where shown on the drawings.
10. For circuit breakers being added to existing panelboards, coordinate the breaker type with existing panelboards. Modify the panel directory accordingly.

**PART 3 - EXECUTION**

**3.1 INSTALLATION**

- A. Installation shall be in accordance with the manufacturer's instructions, the NEC, as shown on the drawings, and as specified.
- B. Locate panelboards so that the present and future conduits can be conveniently connected.
- C. In seismic areas, panelboards shall be adequately anchored and braced in accordance with Section 13 05 41, SEISMIC RESTRAINT REQUIREMENTS FOR NON-STRUCTURAL COMPONENTS to withstand the seismic forces at the location where installed.
- D. Install a printed schedule of circuits in each panelboard after approval by the Resident Engineer. Schedules shall reflect final load descriptions, room numbers, and room names connected to each circuit breaker. Schedules shall be printed on the panelboard directory cards and be installed in the appropriate panelboards.
- E. Mount panelboards such that the maximum height of the top circuit breaker above the finished floor shall not exceed 1980 mm (78 inches).
- F. Provide blank cover for each unused circuit breaker mounting space.

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**3.2 ACCEPTANCE CHECKS AND TESTS**

- A. Perform in accordance with the manufacturer's recommendations. In addition, include the following:
  - 1. Visual Inspection and Tests:
    - a. Compare equipment nameplate data with specifications and approved shop drawings.
    - b. Inspect physical, electrical, and mechanical condition.
    - c. Verify appropriate anchorage and required area clearances.
    - d. Verify that circuit breaker sizes and types correspond to approved shop drawings.
    - e. To verify tightness of accessible bolted electrical connections, use the calibrated torque-wrench method or perform thermographic survey after energization.
    - f. Vacuum-clean enclosure interior. Clean enclosure exterior.

**3.3 FOLLOW-UP VERIFICATION**

- A. Upon completion of acceptance checks, settings, and tests, the Contractor shall demonstrate that the panelboards are in good operating condition and properly performing the intended function.

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SECTION 26 27 26  
WIRING DEVICES

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

- A. This section specifies the furnishing, installation, connection, and testing of wiring devices.

**1.2 RELATED WORK**

- A. Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS: General electrical requirements that are common to more than one section of Division 26.
- B. Section 26 05 33, RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS: Conduit and boxes.
- C. Section 26 05 21, LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES: Cables and wiring.
- D. Section 26 05 26, GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS: Requirements for personnel safety and to provide a low impedance path to ground for possible ground fault currents.
- E. Section 26 51 00, INTERIOR LIGHTING: Fluorescent ballasts and LED drivers for use with manual dimming controls.

**1.3 QUALITY ASSURANCE**

- A. Refer to Paragraph, QUALIFICATIONS (PRODUCTS AND SERVICES), in Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS.

**1.4 SUBMITTALS**

- A. Submit six copies of the following in accordance with Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS.
  - 1. Shop Drawings:
    - a. Submit sufficient information to demonstrate compliance with drawings and specifications.
    - b. Include electrical ratings, dimensions, mounting details, construction materials, grade, and termination information.
  - 2. Manuals:
    - a. Submit, simultaneously with the shop drawings, companion copies of complete maintenance and operating manuals, including technical data sheets and information for ordering replacement parts.

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- b. If changes have been made to the maintenance and operating manuals originally submitted, submit updated maintenance and operating manuals two weeks prior to the final inspection.
- 3. Certifications: Two weeks prior to final inspection, submit the following.
  - a. Certification by the manufacturer that the wiring devices conform to the requirements of the drawings and specifications.
  - b. Certification by the Contractor that the wiring devices have been properly installed and adjusted.

**1.5 APPLICABLE PUBLICATIONS**

- A. Publications listed below (including amendments, addenda, revisions, supplements and errata) form a part of this specification to the extent referenced. Publications are referenced in the text by basic designation only.
- B. National Fire Protection Association (NFPA):
  - 70-11 .....National Electrical Code (NEC)
  - 99-12 .....Health Care Facilities
- C. National Electrical Manufacturers Association (NEMA):
  - WD 1-10 .....General Color Requirements for Wiring Devices
  - WD 6-08 .....Wiring Devices - Dimensional Specifications
- D. Underwriter's Laboratories, Inc. (UL):
  - 5-11 .....Surface Metal Raceways and Fittings
  - 20-10 .....General-Use Snap Switches
  - 231-07 .....Power Outlets
  - 467-07 .....Grounding and Bonding Equipment
  - 498-07 .....Attachment Plugs and Receptacles
  - 943-11 .....Ground-Fault Circuit-Interrupters
  - 1449-07 .....Surge Protective Devices
  - 1472-96 .....Solid State Dimming Controls

**PART 2 - PRODUCTS**

**2.1 RECEPTACLES**

- A. General: All receptacles shall comply with NEMA, NFPA, UL, and as shown on the drawings.
  - 1. Mounting straps shall be plated steel, with break-off plaster ears and shall include a self-grounding feature. Terminal screws shall be brass, brass plated or a copper alloy metal.

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2. Receptacles shall have provisions for back wiring with separate metal clamp type terminals (four minimum) and side wiring from four captively held binding screws.
- B. Duplex Receptacles: Hospital-grade, single phase, 20 ampere, 120 volts, 2-pole, 3-wire, NEMA 5-20R, with break-off feature for two-circuit operation.
  1. Bodies shall be ivory in color.
  2. Switched duplex receptacles shall be wired so that only the top receptacle is switched. The lower receptacle shall be unswitched.
  3. Duplex Receptacles on Emergency Circuit:
    - a. In rooms without emergency powered general lighting, the emergency receptacles shall be of the self-illuminated type.
  4. Ground Fault Interrupter Duplex Receptacles: Shall be an integral unit, hospital-grade, suitable for mounting in a standard outlet box, with end-of-life indication and provisions to isolate the face due to improper wiring.
    - a. Ground fault interrupter shall consist of a differential current transformer, solid state sensing circuitry and a circuit interrupter switch. Device shall have nominal sensitivity to ground leakage current of 4-6 milliamperes and shall function to interrupt the current supply for any value of ground leakage current above five milliamperes (+ or - 1 milliampere) on the load side of the device. Device shall have a minimum nominal tripping time of 0.025 second.
- C. Receptacles; 20, 30, and 50 ampere, 250 Volts: Shall be complete with appropriate cord grip plug.

**2.2 TOGGLE SWITCHES**

- A. Toggle switches shall be totally enclosed tumbler type with nylon bodies. Handles shall be ivory in color unless otherwise specified or shown on the drawings.
  1. Shall be single unit toggle, butt contact, quiet AC type, heavy-duty general-purpose use with an integral self grounding mounting strap with break-off plaster ears and provisions for back wiring with separate metal wiring clamps and side wiring with captively held binding screws.
  2. Switches shall be rated 20 amperes at 120-277 Volts AC.

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**2.3 MANUAL DIMMING CONTROL**

- A. Electronic full-wave manual slide dimmer with on/off switch and audible frequency and EMI/RFI suppression filters.
- B. Provide single-pole or three-way, as shown on the drawings.
- C. Manual dimming control and faceplates shall be ivory in color unless otherwise specified.

**2.4 WALL PLATES**

- A. Wall plates for switches and receptacles shall be type 302 stainless steel. Oversize plates are not acceptable.
- B. For receptacles or switches mounted adjacent to each other, wall plates shall be common for each group of receptacles or switches.
- C. In areas requiring tamperproof wiring devices, wall plates shall be type 302 stainless steel, and shall have tamperproof screws and beveled edges.
- D. Duplex Receptacles on Emergency Circuit: Wall plates shall be type 302 stainless steel, with the word "EMERGENCY" engraved in 6 mm (1/4 inch) red letters.

**PART 3 - EXECUTION**

**3.1 INSTALLATION**

- A. Installation shall be in accordance with the NEC and as shown as on the drawings.
- B. Install wiring devices after wall construction and painting is complete.
- C. The ground terminal of each wiring device shall be bonded to the outlet box with an approved green bonding jumper, and also connected to the branch circuit equipment grounding conductor.
- D. Outlet boxes for toggle switches and manual dimming controls shall be mounted on the strike side of doors.
- E. Provide barriers in multigang outlet boxes to comply with the NEC.
- F. Coordinate the electrical work with the work of other trades to ensure that wiring device flush outlets are positioned with box openings aligned with the face of the surrounding finish material. Pay special attention to installations in cabinet work.

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- G. Exact field locations of floors, walls, partitions, doors, windows, and equipment may vary from locations shown on the drawings. Prior to locating sleeves, boxes and chases for roughing-in of conduit and equipment, the Contractor shall coordinate exact field location of the above items with other trades.
- H. Install wall switches 1.2 M (48 inches) above floor, with the toggle OFF position down.
- I. Install wall dimmers 1.2 M (48 inches) above floor.
- J. Install receptacles 450 mm (18 inches) above floor, and 152 mm (6 inches) above counter backsplash or workbenches. Install specific-use receptacles at heights shown on the drawings.
- K. Install vertically mounted receptacles with the ground pin up. Install horizontally mounted receptacles with the ground pin to the right.
- L. When required or recommended by the manufacturer, use a torque screwdriver. Tighten unused terminal screws.
- M. Label device plates with a permanent adhesive label listing panel and circuit feeding the wiring device.

**3.2 ACCEPTANCE CHECKS AND TESTS**

- A. Perform manufacturer's required field checks in accordance with the manufacturer's recommendations. In addition, include the following:
  - 1. Visual Inspection and Tests:
    - a. Inspect physical and electrical condition.
    - b. Vacuum-clean surface metal raceway interior. Clean metal raceway exterior.
    - c. Test wiring devices for damaged conductors, high circuit resistance, poor connections, inadequate fault current path, defective devices, or similar problems using a portable receptacle tester. Correct circuit conditions, remove malfunctioning units and replace with new, and retest as specified above.
    - d. Test GFCI receptacles.
  - 2. Healthcare Occupancy Tests:
    - a. Test hospital grade receptacles for retention force per NFPA 99.

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SECTION 26 29 11  
MOTOR CONTROLLERS

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

- A. This section specifies the furnishing, installation, connection, and testing of motor controllers, including all low voltage motor controllers and manual motor controllers, indicated as motor controllers in this section.
- B. Motor controllers, whether furnished with the equipment specified in other sections or otherwise shall meet this specification and all related specifications.

**1.2 RELATED WORK**

- A. Section 13 05 41, SEISMIC RESTRAINT REQUIREMENTS FOR NON-STRUCTURAL COMPONENTS: Requirements for seismic restraint for non-structural components.
- B. Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS: Requirements that apply to all sections of Division 26.
- C. Section 26 05 21, LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES: Low-voltage conductors.
- D. Section 26 05 26, GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS: Requirements for personnel safety and to provide a low impedance path for possible ground fault currents.
- E. Section 26 05 33, RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS: Conduits.

**1.3 QUALITY ASSURANCE**

- A. Refer to Paragraph, QUALIFICATIONS (PRODUCTS AND SERVICES), in Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS.

**1.4 SUBMITTALS**

- A. Submit six copies of the following in accordance with Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS.
  - 1. Shop Drawings:
    - a. Submit sufficient information to demonstrate compliance with drawings and specifications.
    - b. Include electrical ratings, dimensions, weights, mounting details, materials, overcurrent protection devices, overload relays, sizes of enclosures, wiring diagrams, starting characteristics, interlocking, and accessories.

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- c. Certification from the manufacturer that representative motor controllers have been seismically tested to International Building Code requirements in accordance with Section 13 05 41, SEISMIC RESTRAINT REQUIREMENTS FOR NON-STRUCTURAL COMPONENTS. Certification shall be based upon simulated seismic forces on a shake table or by analytical methods, but not by experience data or other methods.

**2. Manuals:**

- a. Submit, simultaneously with the shop drawings, companion copies of complete maintenance and operating manuals, including technical data sheets, wiring diagrams, and information for ordering replacement parts.
    - 1) Wiring diagrams shall have their terminals identified to facilitate installation, maintenance, and operation.
    - 2) Wiring diagrams shall indicate internal wiring for each item of equipment and interconnections between the items of equipment.
    - 3) Elementary schematic diagrams shall be provided for clarity of operation.
    - 4) Include the catalog numbers for the correct sizes of overload relays for the motor controllers.
  - b. If changes have been made to the maintenance and operating manuals originally submitted, submit updated maintenance and operating manuals two weeks prior to the final inspection.
- 3. Certifications:** Two weeks prior to final inspection, submit the following.
- a. Certification by the manufacturer that the motor controllers conform to the requirements of the drawings and specifications.
  - b. Certification by the Contractor that the motor controllers have been properly installed, adjusted, and tested.

**1.5 APPLICABLE PUBLICATIONS**

- A. Publications listed below (including amendments, addenda, revisions, supplements, and errata) form a part of this specification to the extent referenced. Publications are referenced in the text by basic designation only.



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- B. Institute of Electrical and Electronic Engineers (IEEE):
  - 519-92 .....Recommended Practices and Requirements for  
Harmonic Control in Electrical Power Systems
  - C37.90.1-02 .....Standard Surge Withstand Capability (SWC) Tests  
for Relays and Relay Systems Associated with  
Electric Power Apparatus
- C. International Code Council (ICC):
  - IBC-12 .....International Building Code
- D. National Electrical Manufacturers Association (NEMA):
  - ICS 1-08 .....Industrial Control and Systems: General  
Requirements
  - ICS 1.1-09 .....Safety Guidelines for the Application,  
Installation and Maintenance of Solid State  
Control
  - ICS 2-05 .....Industrial Control and Systems Controllers,  
Contactors, and Overload Relays Rated 600 Volts
  - ICS 4-05 .....Industrial Control and Systems: Terminal Blocks
  - ICS 6-06 .....Industrial Control and Systems: Enclosures
  - ICS 7-06 .....Industrial Control and Systems: Adjustable-  
Speed Drives
  - ICS 7.1-06 .....Safety Standards for Construction and Guide for  
Selection, Installation, and Operation of  
Adjustable-Speed Drive Systems
  - MG 1 Part 31 .....Inverter Fed Polyphase Motor Standards
- E. National Fire Protection Association (NFPA):
  - 70-11 .....National Electrical Code (NEC)
- F. Underwriters Laboratories Inc. (UL):
  - 508A-07 .....Industrial Control Panels
  - 508C-07 .....Power Conversion Equipment
  - UL 1449-06 .....Surge Protective Devices

**PART 2 - PRODUCTS**

**2.1 MOTOR CONTROLLERS**

- A. Motor controllers shall comply with IEEE, NEMA, NFPA, UL, and as shown on the drawings.

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- B. Motor controllers shall be separately enclosed, unless part of another assembly. For installation in motor control centers, provide plug-in, draw-out type motor controllers up through NEMA size 4. NEMA size 5 and above require bolted connections.
- C. Motor controllers shall be combination type, with magnetic controller per Paragraph 2.3 below and with fused switch disconnecting means, with external operating handle with lock-open padlocking positions and ON-OFF position indicator.
  - 1. Fused Switches:
    - a. Quick-make, quick-break type.
    - b. Minimum duty rating shall be NEMA classification Heavy Duty (HD) for 240 Volts.
    - c. Horsepower rated, and shall have the following features:
      - 1) Copper blades, visible in the OFF position.
      - 2) An arc chute for each pole.
      - 3) Fuse holders for the sizes and types of fuses specified or as shown on the drawings.
- D. Enclosures:
  - 1. Enclosures shall be NEMA-type rated 1, 3R, or 12 as indicated on the drawings or as required per the installed environment.
  - 2. Enclosure doors shall be interlocked to prevent opening unless the disconnecting means is open. A "defeater" mechanism shall allow for inspection by qualified personnel with the disconnect means closed. Provide padlocking provisions.
  - 3. All metal surfaces shall be thoroughly cleaned, phosphatized, and factory primed prior to applying light gray baked enamel finish.
- E. Motor Control Circuits:
  - 1. Shall operate at not more than 120 Volts.
  - 2. Shall be grounded, except where the equipment manufacturer recommends that the control circuits be isolated.
  - 3. For each motor operating over 120 Volts, incorporate a separate, heavy duty, control transformer within each motor controller enclosure.
  - 4. Incorporate primary and secondary overcurrent protection for the control power transformers.

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**F. Overload Relays:**

1. Thermal type. Devices shall be NEMA type.
2. One for each pole.
3. External overload relay reset pushbutton on the door of each motor controller enclosure.
4. Overload relays shall be matched to nameplate full-load current of actual protected motor and with appropriate adjustment for duty cycle.
5. Thermal overload relays shall be tamperproof, not affected by vibration, manual reset, sensitive to single-phasing, and shall have selectable trip classes of 10, 20 and 30.

G. Hand-Off-Automatic (H-O-A) switch is required unless specifically stated on the drawings as not required for a particular controller. H-O-A switch shall be operable without opening enclosure door. H-O-A switch is not required for manual motor controllers.

H. Incorporate into each control circuit a 120 Volt, electronic time-delay relay (ON delay), minimum adjustable range from 0.3 to 10 minutes, with transient protection. Time-delay relay is not required where H-O-A switch is not required.

I. Unless noted otherwise, equip each motor controller with not less than two normally open (N.O.) and two normally closed (N.C.) auxiliary contacts.

J. Provide green (RUN) and red (STOP) pilot lights.

K. Motor controllers incorporated within equipment assemblies shall also be designed for the specific requirements of the assemblies.

L. Additional requirements for specific motor controllers, as indicated in other specification sections, shall also apply.

**2.2 MANUAL MOTOR CONTROLLERS**

A. Shall be in accordance with applicable requirements of 2.1 above.

B. Manual motor controllers shall have the following features:

1. Controllers shall be general-purpose Class A, manually operated type with full voltage controller for induction motors, rated in horsepower.
2. Units shall include thermal overload relays, on-off operator, red and green pilot lights, normally open and normally closed auxiliary contacts.

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C. Fractional horsepower manual motor controllers shall have the following features:

1. Controllers shall be general-purpose Class A, manually operated type with full voltage controller for fractional horsepower induction motors.
2. Units shall include thermal overload relays, red pilot light, and toggle operator.

**2.3 MAGNETIC MOTOR CONTROLLERS**

- A. Shall be in accordance with applicable requirements of 2.1 above.
- B. Controllers shall be general-purpose, Class A magnetic controllers for induction motors rated in horsepower. Minimum NEMA size 0.
- C. Where combination motor controllers are used, combine controller with protective or disconnect device in a common enclosure.
- D. Provide phase loss protection for each controller, with contacts to de-energize the controller upon loss of any phase.
- E. Unless otherwise indicated, provide full voltage non-reversing across-the-line mechanisms for motors less than 75 HP, closed by coil action and opened by gravity. Equip controllers with 120 VAC coils and individual control transformer unless otherwise noted.

**2.4 LOW-VOLTAGE VARIABLE SPEED MOTOR CONTROLLERS (VSMC)**

- A. VSMC shall be in accordance with applicable portion of 2.1 above.
- B. Refer to HVAC Specification 23 05 11.

**PART 3 - EXECUTION**

**3.1 INSTALLATION**

- A. Install motor controllers in accordance with the NEC, as shown on the drawings, and as recommended by the manufacturer.
- B. In seismic areas, motor controllers shall be adequately anchored and braced in accordance with Section 13 05 41, SEISMIC RESTRAINT REQUIREMENTS FOR NON-STRUCTURAL COMPONENTS to withstand the seismic forces at the location where installed.
- C. Install manual motor controllers in flush enclosures in finished areas.
- D. Set field-adjustable switches, auxiliary relays, time-delay relays, timers, and electronic overload relay pickup and trip ranges.

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- E. Adjust trip settings of circuit breakers and motor circuit protectors with adjustable instantaneous trip elements. Initially adjust at six times the motor nameplate full-load ampere ratings and attempt to start motors several times, allowing for motor cool down between starts. If tripping occurs on motor inrush, adjust settings in increments until motors start without tripping. Do not exceed eight times the motor full-load amperes (or 11 times for NEMA Premium Efficiency motors if required). Where these maximum settings do not allow starting of a motor, notify Resident Engineer before increasing settings.

**3.2 ACCEPTANCE CHECKS AND TESTS**

- A. Perform manufacturer's required field tests in accordance with the manufacturer's recommendations. In addition, include the following:
  - 1. Visual Inspection and Tests:
    - a. Compare equipment nameplate data with specifications and approved shop drawings.
    - b. Inspect physical, electrical, and mechanical condition.
    - c. Verify appropriate anchorage, required area clearances, and correct alignment.
    - d. Verify that circuit breaker, motor circuit protector, and fuse sizes and types correspond to approved shop drawings.
    - e. Verify overload relay ratings are correct.
    - f. Vacuum-clean enclosure interior. Clean enclosure exterior.
    - g. Verify tightness of accessible bolted electrical connections by calibrated torque-wrench method in accordance with manufacturer's published data.
    - h. Test all control and safety features of the motor controllers.

**3.3 FOLLOW-UP VERIFICATION**

- A. Upon completion of acceptance checks, settings, and tests, the Contractor shall show by demonstration in service that the motor controllers are in good operating condition and properly performing the intended functions.

**3.4 SPARE PARTS**

- A. Two weeks prior to the final inspection, provide one complete set of spare fuses for each motor controller.

**3.5 INSTRUCTION**

- A. Furnish the services of a factory-trained technician for two 4-hour training periods for instructing personnel in the maintenance and

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operation of the motor controllers, on the dates requested by the  
Resident Engineer.

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SECTION 26 29 21  
ENCLOSED SWITCHES AND CIRCUIT BREAKERS

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

- A. This section specifies the furnishing, installation, and connection of fused and unfused disconnect switches (indicated as switches in this section), and separately-enclosed circuit breakers for use in electrical systems rated 600 V and below.

**1.2 RELATED WORK**

- A. Section 13 05 41, SEISMIC RESTRAINT REQUIREMENTS FOR NON-STRUCTURAL COMPONENTS: Requirements for seismic restraint of non-structural components.
- B. Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS: Requirements that apply to all sections of Division 26.
- C. Section 26 05 19, LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES: Low-voltage conductors.
- D. Section 26 05 26, GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS: Requirements for personnel safety and to provide a low impedance path for possible ground faults.
- E. Section 26 05 33, RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS: Conduits.
- F. Section 26 24 16, PANELBOARDS: Molded-case circuit breakers.

**1.3 QUALITY ASSURANCE**

- A. Refer to Paragraph, QUALIFICATIONS (PRODUCTS AND SERVICES), in Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS.

**1.4 SUBMITTALS**

- A. Submit six copies of the following in accordance with Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS.
  - 1. Shop Drawings:
    - a. Submit sufficient information to demonstrate compliance with drawings and specifications.
    - b. Submit the following data for approval:
      - 1) Electrical ratings, dimensions, mounting details, materials, required clearances, terminations, weight, fuses, circuit breakers, wiring and connection diagrams, accessories, and device nameplate data.
    - c. Certification from the manufacturer that representative enclosed switches and circuit breakers have been seismically tested to

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International Building Code requirements in accordance with Section 13 05 41, SEISMIC RESTRAINT REQUIREMENTS FOR NON-STRUCTURAL COMPONENTS. Certification shall be based upon simulated seismic forces on a shake table or by analytical methods, but not by experience data or other methods.

**2. Manuals:**

- a. Submit complete maintenance and operating manuals including technical data sheets, wiring diagrams, and information for ordering fuses, circuit breakers, and replacement parts.
  - 1) Include schematic diagrams, with all terminals identified, matching terminal identification in the enclosed switches and circuit breakers.
  - 2) Include information for testing, repair, troubleshooting, assembly, and disassembly.
- b. If changes have been made to the maintenance and operating manuals originally submitted, submit updated maintenance and operating manuals two weeks prior to the final inspection.

**3. Certifications:** Two weeks prior to final inspection, submit the following.

- a. Certification by the manufacturer that the enclosed switches and circuit breakers conform to the requirements of the drawings and specifications.
- b. Certification by the Contractor that the enclosed switches and circuit breakers have been properly installed, adjusted, and tested.

**1.5 APPLICABLE PUBLICATIONS**

A. Publications listed below (including amendments, addenda, revisions, supplements, and errata) form a part of this specification to the extent referenced. Publications are referenced in the text by designation only.

**B. International Code Council (ICC):**

IBC-12 .....International Building Code

**C. National Electrical Manufacturers Association (NEMA):**

FU 1-07 .....Low Voltage Cartridge Fuses

KS 1-06 .....Enclosed and Miscellaneous Distribution  
Equipment Switches (600 Volts Maximum)



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D. National Fire Protection Association (NFPA):

70-11 .....National Electrical Code (NEC)

E. Underwriters Laboratories, Inc. (UL):

98-07 .....Enclosed and Dead-Front Switches

248-00 .....Low Voltage Fuses

489-09 .....Molded Case Circuit Breakers and Circuit  
Breaker Enclosures

**PART 2 - PRODUCTS**

**2.1 FUSED SWITCHES RATED 600 AMPERES AND LESS**

A. Switches shall be in accordance with NEMA, NEC, UL, as specified, and as shown on the drawings.

B. Shall be NEMA classified Heavy Duty (HD) for 240 V switches.

C. Shall be horsepower (HP) rated.

D. Shall have the following features:

1. Switch mechanism shall be the quick-make, quick-break type.
2. Copper blades, visible in the open position.
3. An arc chute for each pole.
4. External operating handle shall indicate open and closed positions, and have lock-open padlocking provisions.
5. Mechanical interlock shall permit opening of the door only when the switch is in the open position, defeatable to permit inspection.
6. Fuse holders for the sizes and types of fuses specified.
7. Solid neutral for each switch being installed in a circuit which includes a neutral conductor.
8. Ground lugs for each ground conductor.
9. Enclosures:
  - a. Shall be the NEMA types shown on the drawings.
  - b. Where the types of switch enclosures are not shown, they shall be the NEMA types most suitable for the ambient environmental conditions.
  - c. Shall be finished with manufacturer's standard gray baked enamel paint over pretreated steel.

**2.2 UNFUSED SWITCHES RATED 600 AMPERES AND LESS**

A. Shall be the same as fused switches, but without provisions for fuses.

**2.3 MOTOR RATED TOGGLE SWITCHES**

A. Type 1, general purpose for single-phase motors rated up to 1 horsepower.

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- B. Quick-make, quick-break toggle switch with external reset button and thermal overload protection matched to nameplate full-load current of actual protected motor.

**2.4 CARTRIDGE FUSES**

- A. Shall be in accordance with NEMA FU 1.
- B. Feeders: Class RK1, dual element time delay.
- C. Motor Branch Circuits: Class RK5 dual element time delay.
- D. Other Branch Circuits: Class RK5, dual element time delay.

**2.5 SEPARATELY-ENCLOSED CIRCUIT BREAKERS**

- A. Provide circuit breakers in accordance with the applicable requirements in Section 26 24 16, PANELBOARDS.
- B. Enclosures shall be the NEMA types shown on the drawings. Where the types are not shown, they shall be the NEMA type most suitable for the ambient environmental conditions.

**PART 3 - EXECUTION**

**3.1 INSTALLATION**

- A. Installation shall be in accordance with the manufacturer's instructions, the NEC, as shown on the drawings, and as specified.
- B. In seismic areas, enclosed switches and circuit breakers shall be adequately anchored and braced in accordance with Section 13 05 41, SEISMIC RESTRAINT REQUIREMENTS FOR NON-STRUCTURAL COMPONENTS to withstand the seismic forces at the location where installed.
- C. Fused switches shall be furnished complete with fuses. Arrange fuses such that rating information is readable without removing the fuses.

**3.2 ACCEPTANCE CHECKS AND TESTS**

- A. Perform in accordance with the manufacturer's recommendations. In addition, include the following:
  - 1. Visual Inspection and Tests:
    - a. Compare equipment nameplate data with specifications and approved shop drawings.
    - b. Inspect physical, electrical, and mechanical condition.
    - c. Verify tightness of accessible bolted electrical connections by calibrated torque-wrench method.
    - d. Vacuum-clean enclosure interior. Clean enclosure exterior.

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### 3.3 SPARE PARTS

- A. Two weeks prior to the final inspection, furnish one complete set of spare fuses for each fused disconnect switch installed on the project. Deliver the spare fuses to the Resident Engineer.

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SECTION 26 51 00  
INTERIOR LIGHTING

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This section specifies the furnishing, installation, and connection of the interior lighting systems. The terms "lighting fixture," "fixture," and "luminaire" are used interchangeably.

1.2 RELATED WORK

- A. Section 13 05 41, SEISMIC RESTRAINT REQUIREMENTS FOR NON-STRUCTURAL COMPONENTS: Requirement for seismic restraint for non-structural components.
- B. Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS: Requirements that apply to all sections of Division 26.
- C. Section 26 05 21, LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES: Low-voltage conductors.
- D. Section 26 05 26, GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS: Requirements for personnel safety and to provide a low impedance path to ground for possible ground fault currents.
- E. Section 26 27 26, WIRING DEVICES: Wiring devices used for control of the lighting systems.

1.3 QUALITY ASSURANCE

- A. Refer to Paragraph, QUALIFICATIONS (PRODUCTS AND SERVICES), in Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS.

1.4 SUBMITTALS

- A. Submit six copies of the following in accordance with Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS.
1. Shop Drawings:
- Submit the following information for each type of lighting fixture designated on the LIGHTING FIXTURE SCHEDULE, arranged in order of lighting fixture designation.
  - Material and construction details, include information on housing and optics system.
  - Physical dimensions and description.
  - Wiring schematic and connection diagram.
  - Seismic restraints in accordance with Section 13 05 41, SEISMIC RESTRAINT REQUIREMENTS FOR NON-STRUCTURAL COMPONENTS.
  - Energy efficiency data.

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- g. Photometric data based on laboratory tests complying with IES Lighting Measurements testing and calculation guides.
  - h. Lamp data including lumen output (initial and mean), color rendition index (CRI), rated life (hours), and color temperature (degrees Kelvin).
  - i. Ballast data including ballast type, starting method, ambient temperature, ballast factor, sound rating, system watts, and total harmonic distortion (THD).
  - j. For LED lighting fixtures, submit US DOE LED Lighting Facts label, and IES L70 rated life.
2. Manuals:
  - a. Submit, simultaneously with the shop drawings, complete maintenance and operating manuals, including technical data sheets, wiring diagrams, and information for ordering replacement parts.
  - b. If changes have been made to the maintenance and operating manuals originally submitted, submit updated maintenance and operating manuals two weeks prior to the final inspection.
3. Certifications: Two weeks prior to final inspection, submit the following:
  - a. Certification by the Contractor that the interior lighting systems have been properly installed and tested.

## 1.5 APPLICABLE PUBLICATIONS

- A. Publications listed below (including amendments, addenda, revisions, supplements, and errata) form a part of this specification to the extent referenced. Publications are referenced in the text by designation only.
- B. American National Standards Institute (ANSI):
- C78.1-91 .....Fluorescent Lamps - Rapid-Start Types -  
                                Dimensional and Electrical Characteristics
- C78.376-01 .....Chromaticity of Fluorescent Lamps
- C. American Society for Testing and Materials (ASTM):
- C635-07 .....Manufacture, Performance, and Testing of Metal  
                                Suspension Systems for Acoustical Tile and Lay-  
                                in Panel Ceilings
- D. Environmental Protection Agency (EPA):
- 40 CFR 261 .....Identification and Listing of Hazardous Waste

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- E. Federal Communications Commission (FCC):
  - CFR Title 47, Part 15 ..Radio Frequency Devices
  - CFR Title 47, Part 18 ..Industrial, Scientific, and Medical Equipment
- F. Illuminating Engineering Society (IES):
  - LM-79-08 .....Electrical and Photometric Measurements of  
Solid-State Lighting Products
  - LM-80-08 .....Measuring Lumen Maintenance of LED Light  
Sources
  - LM-82-12 .....Characterization of LED Light Engines and LED  
Lamps for Electrical and Photometric Properties  
as a Function of Temperature
- G. Institute of Electrical and Electronic Engineers (IEEE):
  - C62.41-91 .....Surge Voltages in Low Voltage AC Power Circuits
- H. International Code Council (ICC):
  - IBC-12 .....International Building Code
- I. National Fire Protection Association (NFPA):
  - 70-11 .....National Electrical Code (NEC)
  - 101-12 .....Life Safety Code
- J. National Electrical Manufacturer's Association (NEMA):
  - C82.1-04 .....Lamp Ballasts - Line Frequency Fluorescent Lamp  
Ballasts
  - C82.2-02 .....Method of Measurement of Fluorescent Lamp  
Ballasts
  - C82.4-02 .....Lamp Ballasts - Ballasts for High-Intensity  
Discharge and Low-Pressure Sodium (LPS) Lamps  
(Multiple-Supply Type)
  - C82.11-11 .....Lamp Ballasts - High Frequency Fluorescent Lamp  
Ballasts
  - LL-9-09 .....Dimming of T8 Fluorescent Lighting Systems
  - SSL-1-10 .....Electronic Drivers for LED Devices, Arrays, or  
Systems
- K. Underwriters Laboratories, Inc. (UL):
  - 496-08 .....Lampholders
  - 542-0599 .....Fluorescent Lamp Starters
  - 924-12 .....Emergency Lighting and Power Equipment
  - 935-01 .....Fluorescent-Lamp Ballasts
  - 1598-08 .....Luminaires

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2108-04.....Low-Voltage Lighting Systems

8750-09.....Light Emitting Diode (LED) Light Sources for  
Use in Lighting Products

**PART 2 - PRODUCTS**

**2.1 LIGHTING FIXTURES**

- A. Shall be in accordance with NFPA, UL, as shown on drawings, and as specified.
- B. Sheet Metal:
  - 1. Shall be formed to prevent warping and sagging. Housing, trim and lens frame shall be true, straight (unless intentionally curved), and parallel to each other as designed.
  - 2. Wireways and fittings shall be free of burrs and sharp edges, and shall accommodate internal and branch circuit wiring without damage to the wiring.
  - 3. When installed, any exposed fixture housing surface, trim frame, door frame, and lens frame shall be free of light leaks.
  - 4. Hinged door frames shall operate smoothly without binding. Latches shall function easily by finger action without the use of tools.
- C. Ballasts and lamps shall be serviceable while the fixture is in its normally installed position. Ballasts shall not be mounted to removable reflectors or wireway covers unless so specified.
- D. Lamp Sockets:
  - 1. Fluorescent: Single slot entry type, requiring a one-quarter turn of the lamp after insertion. Lampholder contacts shall be the biting edge type.
- E. Recessed fixtures mounted in an insulated ceiling shall be listed for use in insulated ceilings.
- F. Mechanical Safety: Lighting fixture closures (lens doors, trim frame, hinged housings, etc.) shall be retained in a secure manner by captive screws, chains, aircraft cable, captive hinges, or fasteners such that they cannot be accidentally dislodged during normal operation or routine maintenance.
- G. Metal Finishes:
  - 1. The manufacturer shall apply standard finish (unless otherwise specified) over a corrosion-resistant primer, after cleaning to free the metal surfaces of rust, grease, dirt and other deposits. Edges of pre-finished sheet metal exposed during forming, stamping or



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- shearing processes shall be finished in a similar corrosion resistant manner to match the adjacent surface(s). Fixture finish shall be free of stains or evidence of rusting, blistering, or flaking, and shall be applied after fabrication.
2. Interior light reflecting finishes shall be white with not less than 85 percent reflectances, except where otherwise shown on the drawing.
  3. Exterior finishes shall be as shown on the drawings.
- H. Lighting fixtures shall have a specific means for grounding metallic wireways and housings to an equipment grounding conductor.
- I. Light Transmitting Components for Fluorescent Fixtures:
1. Shall be 100 percent virgin acrylic.
  2. Flat lens panels shall have not less than 3 mm (1/8 inch) of average thickness.
  3. Unless otherwise specified, lenses, reflectors, diffusers, and louvers shall be retained firmly in a metal frame by clips or clamping ring in such a manner as to allow expansion and contraction without distortion or cracking.

**2.2 BALLASTS**

- A. Linear Fluorescent Lamp Ballasts: Multi-voltage (120 - 277V), electronic programmed-start type, designed for type and quantity of lamps indicated. Ballasts shall be designed for full light output unless dimmer or bi-level control is indicated. Ballasts shall include the following features:
1. Lamp end-of-life detection and shutdown circuit (T5 lamps only).
  2. Automatic lamp starting after lamp replacement.
  3. Sound Rating: Class A.
  4. Total Harmonic Distortion (THD): 10 percent or less.
  5. Transient Voltage Protection: IEEE C62.41.1 and IEEE C62.41.2, Category A or better.
  6. Operating Frequency: 20 kHz or higher.
  7. Lamp Current Crest Factor: 1.7 or less.
  8. Ballast Factor: 0.87 or higher unless otherwise indicated.
  9. Power Factor: 0.98 or higher.
  10. EMR/RFI Interference: Comply with CFR Title 47 Part 18 for limitations on electromagnetic and radio-frequency interference for non-consumer equipment.

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11. Dimming ballasts shall be as per above, except dimmable from 100% to level indicated in the LIGHTING FIXTURE SCHEDULE of rated lamp lumens. Dimming ballasts shall be fully compatible with the dimming controls.

**2.3 ELBD - EMERGENCY LIGHTING BYPASS DEVICES**

- A. Shall be UL listed devices designed, built and tested to automatically provide 120/277 VAC standby/emergency branch circuit power to luminaires normally powered, and connected to a "normal" 120/277 VAC switched lighting branch circuit.
  1. Upon loss of "normal" lighting branch circuit power, the devices shall automatically provide standby/emergency AC power to the luminaire, bypassing local switch or dimming control, thereby energizing the luminaire.
- B. Devices shall be UL listed for:
  1. Installation and connection within a given luminaire's housing or enclosure.
  2. Installation immediately adjacent to a given luminaire's housing or enclosure, with wiring installed to the luminaire.
- C. Type/Application:
  1. ELBD - Shall be limited to application on linear fluorescent lamp luminaires only. Maximum 3A load per device.
  2. ELBD - Factory installed integral to the luminaire housing, or field installed immediately adjacent to a given specific luminaire.
- D. The devices shall provide voltage sensing circuitry, and integral micro-relay switches, to automatically and simultaneously provide emergency AC power to the connected luminaire(s), upon loss of the "normal" power source.
- E. Device shall be self-contained, requiring only factory or field wiring to its input/output wiring leads.
- F. The device manufacturer shall provide a full replacement five (5) year warranty.

**2.4 LAMPS**

- A. Linear T5 Fluorescent Lamps:
  1. Except as indicated below, lamps shall be low-mercury energy saving type, have a color temperature between 3500° and 4100°K, a Color Rendering Index (CRI) equal or greater than 80, average rated life equal to or greater than 24,000 hours when used with an instant

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start ballast and 30,000 hours when used with a programmed or rapid start ballast (based on 3 hour starts), and be suitable for use with dimming ballasts, unless otherwise indicated.

2. Lamps shall comply with EPA Toxicity Characteristic Leachate Procedure (TCLP) requirements.

**2.5 LED EXIT LIGHT FIXTURES**

- A. Exit light fixtures shall meet applicable requirements of NFPA and UL.
- B. Housing and door shall be die-cast aluminum.
- C. For general purpose exit light fixtures, door frame shall be hinged, with latch.
- D. Finish shall be satin or fine-grain brushed aluminum.
- E. There shall be no radioactive material used in the fixtures.
- F. Fixtures:

1. Inscription panels shall be cast or stamped aluminum a minimum of 2.25 mm (0.090 inch) thick, stenciled with 150 mm (6 inch) high letters, baked with red color stable plastic or fiberglass. Lamps shall be luminous Light Emitting Diodes (LED) mounted in center of letters on red color stable plastic or fiberglass.
2. Double-Faced Fixtures: Provide double-faced fixtures where required or as shown on drawings.
3. Directional Arrows: Provide directional arrows as part of the inscription panel where required or as shown on drawings. Directional arrows shall be the "chevron-type" of similar size and width as the letters and meet the requirements of NFPA 101.

- G. Voltage: Multi-voltage (120 - 277V).

**2.6 LED LIGHT FIXTURES**

- A. General:
  1. LED light fixtures shall be in accordance with IES, NFPA, UL, as shown on the drawings, and as specified.
  2. LED light fixtures shall be Reduction of Hazardous Substances (RoHS)-compliant.
  3. LED drivers shall include the following features unless otherwise indicated:
    - a. Minimum efficiency: 85% at full load.
    - b. Minimum Operating Ambient Temperature: -20• C. (-4• F.)
    - c. Input Voltage: 120 - 277V (±10%) at 60 Hz.
    - d. Integral short circuit, open circuit, and overload protection.

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- e. Power Factor: • 0.95.
- f. Total Harmonic Distortion: • 20%.
- g. Comply with FCC 47 CFR Part 15.
- 4. LED modules shall include the following features unless otherwise indicated:
  - a. Comply with IES LM-79 and LM-80 requirements.
  - b. Minimum CRI 80 and color temperature 3000• K unless otherwise specified in LIGHTING FIXTURE SCHEDULE.
  - c. Minimum Rated Life: 50,000 hours per IES L70.
  - d. Light output lumens as indicated in the LIGHTING FIXTURE SCHEDULE.
- B. LED Downlights:
  - 1. Housing, LED driver, and LED module shall be products of the same manufacturer.
- C. LED Troffers:
  - 1. LED drivers, modules, and reflector shall be accessible, serviceable, and replaceable from below the ceiling.
  - 2. Housing, LED driver, and LED module shall be products of the same manufacturer.

**2.7 EXTRA MATERIALS**

- A. Above and beyond the quantities of material required to execute the contract, provide the following extra materials:
  - 1. Spare lamps:
    - a. Flourescent  
F28/T5            One case of 40.
    - b. LED:  
Provide 10 percent spare of L.E.D. boards and drivers for all lighting fixture types being provided on the project. Refer to Luminaire Schedule on Drawings for specific L.E.D. light fixture types being provided on the project.

**PART 3 - EXECUTION**

**3.1 INSTALLATION**

- A. Installation shall be in accordance with the NEC, manufacturer's instructions, and as shown on the drawings or specified.
- B. Align, mount, and level the lighting fixtures uniformly.
- C. Wall-mounted fixtures shall be attached to the studs in the walls, or to a 20 gauge metal backing plate that is attached to the studs in the

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walls. Lighting fixtures shall not be attached directly to gypsum board.

**D. Lighting Fixture Supports:**

1. Shall provide support for all of the fixtures. Supports may be anchored to channels of the ceiling construction, to the structural slab or to structural members within a partition, or above a suspended ceiling.
2. Shall maintain the fixture positions after cleaning and relamping.
3. Shall support the lighting fixtures without causing the ceiling or partition to deflect.
4. Hardware for recessed lighting fixtures:
  - a. All fixture mounting devices connecting fixtures to the ceiling system or building structure shall have a capacity for a horizontal force of 100 percent of the fixture weight and a vertical force of 400 percent of the fixture weight.
  - b. Mounting devices shall clamp the fixture to the ceiling system structure (main grid runners or fixture framing cross runners) at four points in such a manner as to resist spreading of these supporting members. Each support point device shall utilize a screw or approved hardware to "lock" the fixture housing to the ceiling system, restraining the fixture from movement in any direction relative to the ceiling. The screw (size No. 10 minimum) or approved hardware shall pass through the ceiling member (T-bar, channel or spline), or it may extend over the inside of the flange of the channel (or spline) that faces away from the fixture, in a manner that prevents any fixture movement.
  - c. In addition to the above, the following is required for fixtures exceeding 9 kg (20 pounds) in weight.
    - 1) Where fixtures mounted in ASTM Standard C635 "Intermediate Duty" and "Heavy Duty" ceilings and weigh between 9 kg and 25 kg (20 pounds and 56 pounds), provide two 12 gauge safety hangers hung slack between diagonal corners of the fixture and the building structure.
    - 2) Where fixtures weigh over 25 kg (56 pounds), they shall be independently supported from the building structure by approved hangers. Two-way angular bracing of hangers shall be provided to prevent lateral motion.

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- d. Where ceiling cross runners are installed for support of lighting fixtures, they must have a carrying capacity equal to that of the main ceiling runners and be rigidly secured to the main runners.
5. Surface mounted lighting fixtures:
- a. Fixtures shall be bolted against the ceiling independent of the outlet box at four points spaced near the corners of each unit. The bolts (or stud-clips) shall be minimum 6 mm (1/4 inch) bolt, secured to main ceiling runners and/or secured to cross runners. Non-turning studs may be attached to the main ceiling runners and cross runners with special non-friction clip devices designed for the purpose, provided they bolt through the runner, or are also secured to the building structure by 12 gauge safety hangers. Studs or bolts securing fixtures weighing in excess of 25 kg (56 pounds) shall be supported directly from the building structure.
  - b. Where ceiling cross runners are installed for support of lighting fixtures, they must have a carrying capacity equal to that of the main ceiling runners and be rigidly secured to the main runners.
  - c. Fixtures less than 6.8 kg (15 pounds) in weight and occupying less than 3715 sq cm (two square feet) of ceiling area may, when designed for the purpose, be supported directly from the outlet box when all the following conditions are met.
    - 1) Screws attaching the fixture to the outlet box pass through round holes (not key-hole slots) in the fixture body.
    - 2) The outlet box is attached to a main ceiling runner (or cross runner) with approved hardware.
    - 3) The outlet box is supported vertically from the building structure.
  - d. Fixtures mounted in open construction shall be secured directly to the building structure with approved bolting and clamping devices.

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6. Single or double pendant-mounted lighting fixtures:
  - a. Each stem shall be supported by an approved outlet box mounted swivel joint and canopy which holds the stem captive and provides spring load (or approved equivalent) dampening of fixture oscillations. Outlet box shall be supported vertically from the building structure.
7. Outlet boxes for support of lighting fixtures (where permitted) shall be secured directly to the building structure with approved devices or supported vertically in a hung ceiling from the building structure with a nine gauge wire hanger, and be secured by an approved device to a main ceiling runner or cross runner to prevent any horizontal movement relative to the ceiling.
- E. Furnish and install the new lamps as specified for all lighting fixtures installed under this project.
- F. The electrical and ceiling trades shall coordinate to ascertain that approved lighting fixtures are furnished in the proper sizes and installed with the proper devices (hangers, clips, trim frames, flanges, etc.), to match the ceiling system being installed.
- G. Bond lighting fixtures to the grounding system as specified in Section 26 05 26, GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS.
- H. At completion of project, replace all defective components of the lighting fixtures at no cost to the Government.

**3.2 ACCEPTANCE CHECKS AND TESTS**

- A. Perform the following:
  1. Visual Inspection:
    - a. Verify proper operation by operating the lighting controls.
    - b. Visually inspect for damage to fixtures, lenses, reflectors, diffusers, and louvers. Clean fixtures, lenses, reflectors, diffusers, and louvers that have accumulated dust, dirt, or fingerprints during construction.
  2. Electrical tests:
    - a. Exercise dimming components of the lighting fixtures over full range of dimming capability by operating the control devices(s) in the presence of the Resident Engineer. Observe for visually detectable flicker over full dimming range, and replace defective components at no cost to the Government.

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- b. Burn-in all lamps that require specific aging period to operate properly, prior to occupancy by Government. Burn-in period to be 40 hours minimum, unless specifically recommended otherwise by the lamp manufacturer. Burn-in dimmed fluorescent and compact fluorescent lamps for at least 100 hours at full voltage, unless specifically recommended otherwise by the lamp manufacturer.

Replace any lamps and ballasts which fail during burn-in.

**3.3 FOLLOW-UP VERIFICATION**

- A. Upon completion of acceptance checks and tests, the Contractor shall show by demonstration in service that the lighting systems are in good operating condition and properly performing the intended function.

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**SECTION 27 05 11**  
**REQUIREMENTS FOR COMMUNICATIONS INSTALLATIONS**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

- A. This Section, Requirements for Communications Installations, applies to all sections of Division 27.
- B. Furnish and install communications cabling, systems, equipment, and accessories in accordance with the specifications and drawings. Capacities and ratings of transformers, cable, and other items and arrangements for the specified items are shown on drawings.

**1.2 MINIMUM REQUIREMENTS**

- A. References to industry and trade association standards and codes are minimum installation requirement standards.
- B. Drawings and other specification sections shall govern in those instances where requirements are greater than those specified in the above standards.

**1.3 QUALIFICATIONS (PRODUCTS AND SERVICES)**

- A. Manufacturers Qualifications: The manufacturer shall regularly and presently produce, as one of the manufacturer's principal products, the equipment and material specified for this project, and shall have manufactured the item for at least three years.
- B. Product Qualification:
  - 1. Manufacturer's product shall have been in satisfactory operation, on three installations of similar size and type as this project, for approximately three years.
  - 2. The Government reserves the right to require the Contractor to submit a list of installations where the products have been in operation before approval.
- C. Service Qualifications: There shall be a permanent service organization maintained or trained by the manufacturer which will render satisfactory service to this installation within four hours of receipt of notification that service is needed. Submit name and address of service organizations.

**1.4 MANUFACTURED PRODUCTS**

- A. Materials and equipment furnished shall be of current production by manufacturers regularly engaged in the manufacture of such items, for which replacement parts shall be available.
- B. When more than one unit of the same class of equipment is required, such units shall be the product of a single manufacturer.
- C. Equipment Assemblies and Components:

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1. Components of an assembled unit need not be products of the same manufacturer.
  2. Manufacturers of equipment assemblies, which include components made by others, shall assume complete responsibility for the final assembled unit.
  3. Components shall be compatible with each other and with the total assembly for the intended service.
  4. Constituent parts which are similar shall be the product of a single manufacturer.
- D. Factory wiring shall be identified on the equipment being furnished and on all wiring diagrams.
- E. When Factory Testing Is Specified:
1. The Government shall have the option of witnessing factory tests. The contractor shall notify the VA through the Resident Engineer a minimum of 15 working days prior to the manufacturers making the factory tests.
  2. Four copies of certified test reports containing all test data shall be furnished to the Resident Engineer prior to final inspection and not more than 90 days after completion of the tests.
  3. When equipment fails to meet factory test and re-inspection is required, the contractor shall be liable for all additional expenses, including expenses of the Government.

**1.5 EQUIPMENT REQUIREMENTS**

Where variations from the contract requirements are requested in accordance with the GENERAL CONDITIONS and Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES, the connecting work and related components shall include, but not be limited to additions or changes to branch circuits, circuit protective devices, conduits, wire, feeders, controls, panels and installation methods.

**1.6 EQUIPMENT PROTECTION**

- A. Equipment and materials shall be protected during shipment and storage against physical damage, dirt, moisture, cold and rain:
1. During installation, enclosures, equipment, controls, controllers, circuit protective devices, and other like items, shall be protected against entry of foreign matter; and be vacuum cleaned both inside and outside before testing and operating and repainting if required.
  2. Damaged equipment shall be, as determined by the Resident Engineer, placed in first class operating condition or be returned to the source of supply for repair or replacement.

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3. Painted surfaces shall be protected with factory installed removable heavy kraft paper, sheet vinyl or equal.
4. Damaged paint on equipment and materials shall be refinished with the same quality of paint and workmanship as used by the manufacturer so repaired areas are not obvious.

**1.7 WORK PERFORMANCE**

- A. Job site safety and worker safety is the responsibility of the contractor.
- B. For work on existing stations, arrange, phase and perform work to assure communications service for other buildings at all times. Refer to Article OPERATIONS AND STORAGE AREAS under Section 01 00 00, GENERAL REQUIREMENTS.
- C. New work shall be installed and connected to existing work neatly and carefully. Disturbed or damaged work shall be replaced or repaired to its prior conditions, as required by Section 01 00 00, GENERAL REQUIREMENTS.
- D. Coordinate location of equipment and pathways with other trades to minimize interferences. See the GENERAL CONDITIONS.

**1.8 EQUIPMENT INSTALLATION AND REQUIREMENTS**

- A. Equipment location shall be as close as practical to locations shown on the drawings.
- B. Inaccessible Equipment:
  1. Where the Government determines that the Contractor has installed equipment not conveniently accessible for operation and maintenance, the equipment shall be removed and reinstalled as directed at no additional cost to the Government.
  2. "Conveniently accessible" is defined as being capable of being reached without the use of ladders, or without climbing or crawling under or over obstacles such as, but not limited to, motors, pumps, belt guards, transformers, piping, ductwork, conduit and raceways.

**1.9 EQUIPMENT IDENTIFICATION**

- A. Install an identification sign which clearly indicates information required for use and maintenance of equipment.
- B. Nameplates shall be laminated black phenolic resin with a white core with engraved lettering, a minimum of 6 mm (1/4 inch) high. Secure nameplates with screws. Nameplates that are furnished by manufacturer as a standard catalog item, or where other method of identification is herein specified, are exceptions.

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**1.10 SUBMITTALS**

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. The Government's approval shall be obtained for all equipment and material before delivery to the job site. Delivery, storage, or installation of equipment or material which has not had prior approval will not be permitted at the job site.
- C. All submittals shall include adequate descriptive literature, catalog cuts, shop drawings, and other data necessary for the Government to ascertain that the proposed equipment and materials comply with specification requirements. Catalog cuts submitted for approval shall be legible and clearly identify equipment being submitted.
- D. Submittals for individual systems and equipment assemblies which consist of more than one item or component shall be made for the system or assembly as a whole. Partial submittals will not be considered for approval.
  - 1. Mark the submittals, "SUBMITTED UNDER SECTION\_\_\_\_\_".
  - 2. Submittals shall be marked to show specification reference including the section and paragraph numbers.
  - 3. Submit each section separately.
- E. The submittals shall include the following:
  - 1. Information that confirms compliance with contract requirements. Include the manufacturer's name, model or catalog numbers, catalog information, technical data sheets, shop drawings, pictures, nameplate data and test reports as required.
  - 2. Submittals are required for all equipment anchors and supports. Submittals shall include weights, dimensions, center of gravity, standard connections, manufacturer's recommendations and behavior problems (e.g., vibration, thermal expansion,) associated with equipment or piping so that the proposed installation can be properly reviewed.
    - a. Public address, mass notification, and voice communications systems are critical equipment that shall have a seismic component importance factor 1.5.
  - 3. Elementary and interconnection wiring diagrams for communication and signal systems, control system and equipment assemblies. All terminal points and wiring shall be identified on wiring diagrams.
  - 4. Parts list which shall include those replacement parts recommended by the equipment manufacturer, quantity of parts, current price and availability of each part.

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F. Manuals: Submit in accordance with Section 01 00 00, GENERAL REQUIREMENTS.

1. Maintenance and Operation Manuals: Submit as required for systems and equipment specified in the technical sections. Furnish four copies, bound in hardback binders, (manufacturer's standard binders) or an approved equivalent. Furnish one complete manual as specified in the technical section but in no case later than prior to performance of systems or equipment test, and furnish the remaining manuals prior to contract completion.
2. Inscribe the following identification on the cover: the words "MAINTENANCE AND OPERATION MANUAL," the name and location of the system, equipment, building, name of Contractor, and contract number. Include in the manual the names, addresses, and telephone numbers of each subcontractor installing the system or equipment and the local representatives for the system or equipment.
3. Provide a "Table of Contents" and assemble the manual to conform to the table of contents, with tab sheets placed before instructions covering the subject. The instructions shall be legible and easily read, with large sheets of drawings folded in.
4. The manuals shall include:
  - a. Internal and interconnecting wiring and control diagrams with data to explain detailed operation and control of the equipment.
  - b. A control sequence describing start-up, operation, and shutdown.
  - c. Description of the function of each principal item of equipment.
  - d. Installation and maintenance instructions.
  - e. Safety precautions.
  - f. Diagrams and illustrations.
  - g. Testing methods.
  - h. Performance data.
  - i. Pictorial "exploded" parts list with part numbers. Emphasis shall be placed on the use of special tools and instruments. The list shall indicate sources of supply, recommended spare parts, and name of servicing organization.
  - j. Appendix; list qualified permanent servicing organizations for support of the equipment, including addresses and certified qualifications.

G. Approvals will be based on complete submission of manuals together with shop drawings.

H. After approval and prior to installation, furnish the Resident Engineer with one sample of each of the following:

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1. A 300 mm (12 inch) length of each type and size of wire and cable along with the tag from the coils of reels from which the samples were taken.
2. Each type of conduit and pathway coupling, bushing and termination fitting.
3. Raceway and pathway hangers, clamps and supports.
4. Duct sealing compound.

**1.11 SINGULAR NUMBER**

Where any device or part of equipment is referred to in these specifications in the singular number (e.g., "the switch"), this reference shall be deemed to apply to as many such devices as are required to complete the installation as shown on the drawings.

**1.12 TRAINING**

- A. Training shall be provided in accordance with Article, INSTRUCTIONS, of Section 01 00 00, GENERAL REQUIREMENTS.
- B. Training shall be provided for the particular equipment or system as required in each associated specification.
- C. A training schedule shall be developed and submitted by the contractor and approved by the Resident Engineer at least 30 days prior to the planned training.

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SECTION 27 05 26  
GROUNDING AND BONDING FOR COMMUNICATIONS SYSTEMS

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

- A. This section specifies general grounding and bonding requirements of telecommunication installations for equipment operations.
- B. "Grounding electrode system" refers to all electrodes required by NEC, as well as including made, supplementary, telecommunications system grounding electrodes.
- C. The terms "connect" and "bond" are used interchangeably in this specification and have the same meaning.

**1.2 RELATED WORK**

- A. Section 27 10 00, STRUCTURED CABLING: Low Voltage power and lighting wiring.

**1.3 SUBMITTALS**

- A. Submit in accordance with Section 27 05 11, REQUIREMENTS FOR COMMUNICATIONS INSTALLATIONS.
- B. Shop Drawings:
  - 1. Sufficient information, clearly presented, shall be included to determine compliance with drawings and specifications.
  - 2. Include the location of system grounding electrode connections and the routing of aboveground and underground grounding electrode conductors.
- C. Test Reports: Provide certified test reports of ground resistance.
- D. Certifications: Two weeks prior to final inspection, submit four copies of the following to the Resident Engineer:
  - 1. Certification that the materials and installation is in accordance with the drawings and specifications.
  - 2. Certification, by the Contractor, that the complete installation has been properly installed and tested.

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**1.4 APPLICABLE PUBLICATIONS**

Publications listed below (including amendments, addenda, revisions, supplements, and errata) form a part of this specification to the extent referenced. Publications are referenced in the text by the basic designation only.

- A. American Society for Testing and Materials (ASTM):
  - B1-2001 .....Standard Specification for Hard-Drawn Copper Wire
  - B8-2004 .....Standard Specification for Concentric-Lay-Stranded Copper Conductors, Hard, Medium-Hard, or Soft
- B. Institute of Electrical and Electronics Engineers, Inc. (IEEE):
  - 81-1983 .....IEEE Guide for Measuring Earth Resistivity, Ground Impedance, and Earth Surface Potentials of a Ground System
- C. National Fire Protection Association (NFPA):
  - 70-2005 .....National Electrical Code (NEC)
- D. Telecommunications Industry Association, (TIA)
  - J-STO-607-A-2002 .....Commercial Building Grounding (Earthing) and Bonding Requirements for Telecommunications
- E. Underwriters Laboratories, Inc. (UL):
  - 44-2005 .....Thermoset-Insulated Wires and Cables
  - 83-2003 .....Thermoplastic-Insulated Wires and Cables
  - 467-2004 .....Grounding and Bonding Equipment
  - 486A-486B-2003 .....Wire Connectors

**PART 2 - PRODUCTS**

**2.1 GROUNDING AND BONDING CONDUCTORS**

- A. Equipment grounding conductors shall be UL 83 insulated stranded copper, except that sizes 6 mm<sup>2</sup> (10 AWG) and smaller shall be solid copper. Insulation color shall be continuous green for all equipment grounding conductors, except that wire sizes 25 mm<sup>2</sup> (4 AWG) and larger shall be permitted to be identified per NEC.
- B. Bonding conductors shall be ASTM B8 bare stranded copper, except that sizes 6 mm<sup>2</sup> (10 AWG) and smaller shall be ASTM B1 solid bare copper wire.
- C. Isolated Power System: Type XHHW-2 insulation with a dielectric constant of 3.5 or less.



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- D. Telecom System Grounding Riser Conductor: Telecommunications Grounding Riser shall be in accordance with J STO-607A. Use a minimum 50mm<sup>2</sup> (1/0 AWG) insulated stranded copper grounding conductor unless indicated otherwise.

**2.2 SPLICES AND TERMINATION COMPONENTS**

Components shall meet or exceed UL 467 and be clearly marked with the manufacturer, catalog number, and permitted conductor size(s).

**2.3 TELECOMMUNICATION SYSTEM GROUND BUSBARS**

- A. Provide solid copper busbar, pre-drilled from two-hole lug connections with a minimum thickness of 6 mm (1/4 inch) for wall and backboard mounting using standard insulators sized as follows:
1. Room Signal Grounding: 300 mm x 100 mm (12 inches x 4 inch).
  2. Master Signal Ground: 600 mm x 100 mm (24 inches x 4 inch).

**2.4 GROUND CONNECTIONS**

- A. Above Grade:
1. Bonding Jumpers: compression type connectors, using zinc-plated fasteners and external tooth lockwashers.
  2. Ground Busbars: Two-hole compression type lugs using tin-plated copper or copper alloy bolts and nuts.
  3. Rack and Cabinet Ground Bars: one-hole compression-type lugs using zinc-plated or copper alloy fasteners.
- B. Cable Shields: Make ground connections to multipair communications cables with metallic shields using shield bonding connectors with screw stud connection.

**2.5 EQUIPMENT RACK AND CABINET GROUND BARS**

Provide solid copper ground bars designed for mounting on the framework of open or cabinet-enclosed equipment racks with minimum dimensions of 4 mm thick by 19 mm wide (3/8 inch x 3/4 inch).

**2.6 GROUND TERMINAL BLOCKS**

At any equipment mounting location (e.g. backboards and hinged cover enclosures) where rack-type ground bars cannot be mounted, provide 78 splice case ground accessories.

Splice case grounding and bonding accessories shall be supplied by the splice case manufacturer when available. Otherwise, use 16 mm<sup>2</sup> (6 AWG) insulated ground wire with shield bonding connectors.

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**PART 3 - EXECUTION**

**3.1 GENERAL**

- A. Ground in accordance with the NEC, as shown on drawings, and as hereinafter specified.
- B. System Grounding:
  - 1. Secondary service neutrals: Ground at the supply side of the secondary disconnecting means and at the related transformers.
  - 2. Separately derived systems (transformers downstream from the service entrance): Ground the secondary neutral.
  - 3. Isolation transformers and isolated power systems shall not be system grounded.
- C. Equipment Grounding: Metallic structures (including ductwork and building steel), enclosures, raceways, junction boxes, outlet boxes, cabinets, machine frames, and other conductive items in close proximity with electrical circuits shall be bonded and grounded.

**3.2 INACCESSIBLE GROUNDING CONNECTIONS**

Make grounding connections, which are buried or otherwise normally inaccessible (except connections for which periodic testing access is required) by exothermic weld.

**3.3 SECONDARY EQUIPMENT AND CIRCUITS**

- A. Main Bonding Jumper: Bond the secondary service neutral to the ground bus in the service equipment.
- B. Metallic Piping, Building Steel, and Supplemental Electrode(s):
  - 1. Provide a grounding electrode conductor sized per NEC between the service equipment ground bus and all metallic water and gas pipe systems, building steel, and supplemental or made electrodes. Jumper insulating joints in the metallic piping. All connections to electrodes shall be made with fittings that conform to UL 467.
  - 2. Provide a supplemental ground electrode and bond to the grounding electrode system.
- C. Conduit Systems:
  - 1. Ground all metallic conduit systems. All metallic conduit systems shall contain an equipment grounding conductor.
  - 2. Non-metallic conduit systems shall contain an equipment grounding conductor, except that non-metallic feeder conduits which carry a grounded conductor from exterior transformers to interior or

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- building-mounted service entrance equipment need not contain an equipment grounding conductor.
3. Conduit containing only a grounding conductor, and which is provided for mechanical protection of the conductor, shall be bonded to that conductor at the entrance and exit from the conduit.
- D. Feeders and Branch Circuits: Install equipment grounding conductors with all feeders and power and lighting branch circuits.
- E. Boxes, Cabinets, Enclosures, and Panelboards:
1. Bond the equipment grounding conductor to each pullbox, junction box, outlet box, device box, cabinets, and other enclosures through which the conductor passes (except for special grounding systems for intensive care units and other critical units shown).
  2. Provide lugs in each box and enclosure for equipment grounding conductor termination.
  3. Provide ground bars in panelboards, bolted to the housing, with sufficient lugs to terminate the equipment grounding conductors.
- F. Receptacles shall not be grounded through their mounting screws. Ground with a jumper from the receptacle green ground terminal to the device box ground screw and the branch circuit equipment grounding conductor.

**3.4 CORROSION INHIBITORS**

When making ground and ground bonding connections, apply a corrosion inhibitor to all contact surfaces. Use corrosion inhibitor appropriate for protecting a connection between the metals used.

**3.5 CONDUCTIVE PIPING**

- A. Bond all conductive piping systems, interior and exterior, to the building to the grounding electrode system. Bonding connections shall be made as close as practical to the equipment ground bus.
- B. In operating rooms and at intensive care and coronary care type beds, bond the gases and suction piping, at the outlets, directly to the room or patient ground bus.

**3.6 TELECOMMUNICATIONS SYSTEM**

- A. Bond telecommunications system grounding equipment to the electrical grounding electrode system.
- B. Furnish and install all wire and hardware required to properly ground, bond and connect communications raceway, cable tray, metallic cable shields, and equipment to a ground source.

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- C. Ground bonding jumpers shall be continuous with no splices. Use the shortest length of bonding jumper possible.
- D. Provide ground paths that are permanent and continuous with a resistance of 1 ohm or less from raceway, cable tray, and equipment connections to the building grounding electrode. The resistance across individual bonding connections shall be 10 milli ohms or less.
- E. Above-Grade Grounding Connections: When making bolted or screwed connections to attach bonding jumpers, remove paint to expose the entire contact surface by grinding where necessary; thoroughly clean all connector, plate and other contact surfaces; and apply an appropriate corrosion inhibitor to all surfaces before joining.
- F. Bonding Jumpers:
  - 1. Use insulated ground wire of the size and type shown on the Drawings or use a minimum of 16 mm<sup>2</sup> (6 AWG) insulated copper wire.
  - 2. Assemble bonding jumpers using insulated ground wire terminated with compression connectors.
  - 3. Use compression connectors of proper size for conductors specified. Use connector manufacturer's compression tool.
- G. Bonding Jumper Fasteners:
  - 1. Conduit: Fasten bonding jumpers using screw lugs on grounding bushings or conduit strut clamps, or the clamp pads on push-type conduit fasteners. When screw lug connection to a conduit strut clamp is not possible, fasten the plain end of a bonding jumper wire by slipping the plain end under the conduit strut clamp pad; tighten the clamp screw firmly. Where appropriate, use zinc-plated external tooth lockwashers.
  - 2. Wireway and Cable Tray: Fasten bonding jumpers using zinc-plated bolts, external tooth lockwashers, and nuts. Install protective cover, e.g., zinc-plated acorn nuts on any bolts extending into wireway or cable tray to prevent cable damage.
  - 3. Ground Plates and Busbars: Fasten bonding jumpers using two-hole compression lugs. Use tin-plated copper or copper alloy bolts, external tooth lockwashers, and nuts.
  - 4. Unistrut and Raised Floor Stringers: Fasten bonding jumpers using zinc-plated, self-drill screws and external tooth lockwashers.

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**3.7 COMMUNICATION ROOM GROUNDING**

- A. Telecommunications Ground Busbars:
  - 1. Provide communications room telecommunications ground busbar hardware at 950 mm (18 inches) at locations indicated on the Drawings.
  - 2. Connect the telecommunications room ground busbars to other room grounding busbars as indicated on the Grounding Riser diagram.
- B. Telephone-Type Cable Rack Systems: aluminum pan installed on telephone-type cable rack serves as the primary ground conductor within the communications room. Make ground connections by installing the following bonding jumpers:
  - 1. Install a 16 mm<sup>2</sup> (6 AWG) bonding between the telecommunications ground busbar and the nearest access to the aluminum pan installed on the cable rack.
  - 2. Use 16 mm<sup>2</sup> (6 AWG) bonding jumpers across aluminum pan junctions.
- C. Self-Supporting and Cabinet-Mounted Equipment Rack Ground Bars:
  - 1. When ground bars are provided at the rear of lineup of bolted together equipment racks, bond the copper ground bars together using solid copper splice plates supplied by the ground bar manufacturer.
  - 2. Bond together nonadjacent ground bars on equipment racks and cabinets with 16 mm<sup>2</sup> (6 AWG) insulated copper wire bonding jumpers attached at each end with compression-type connectors and mounting bolts.
  - 3. Provide a 16 mm<sup>2</sup> (6 AWG) bonding jumper between the rack and/or cabinet ground busbar and the aluminum pan of an overhead cable tray or the raised floor stringer as appropriate.
- D. Backboards: Provide a screw lug-type terminal block or drilled and tapped copper strip near the top of backboards used for communications cross-connect systems. Connect backboard ground terminals to the aluminum pan in the telephone-type cable tray using an insulated 16 mm<sup>2</sup> (16 AWG) bonding jumper.
- E. Other Communication Room Ground Systems: Ground all metallic conduit, anti-static flooring, wireways, and other metallic equipment located away from equipment racks or cabinets to the cable tray pan or the telecommunications ground busbar, whichever is closer, using insulated 16 mm<sup>2</sup> (6 AWG) ground wire bonding jumpers.

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**3.8 COMMUNICATIONS CABLE GROUNDING**

- A. Bond all metallic cable sheaths in multipair communications cables together at each splicing and/or terminating location to provide 100 percent metallic sheath continuity throughout the communications distribution system.
  - 1. At terminal points, install a cable shield bonding connector provide a screw stud connection for ground wire. Use a bonding jumper to connect the cable shield connector to an appropriate ground source like the rack or cabinet ground bar.
  - 2. Bond all metallic cable shields together within splice closures using cable shield bonding connectors or the splice case grounding and bonding accessories provided by the splice case manufacturer. When an external ground connection is provided as part of splice closure, connect to an approved ground source and all other metallic components and equipment at that location.

**3.9 COMMUNICATIONS CABLE TRAY SYSTEMS:**

- A. Bond the metallic structures of one cable tray in each tray run following the same path to provide 100 percent electrical continuity throughout this cable tray systems as follows:
  - 1. Splice plates provided by the cable tray manufacturer can be used for providing a ground bonding connection between cable tray sections when the resistance across a bolted connection is 10 milliohms or less. The Subcontractor shall verify this loss by testing across one splice plate connection in the presence of the Contractor.
  - 2. Install a 16 mm<sup>2</sup> (6 AWG) bonding jumper across each cable tray splice or junction where splice plates cannot be used.
  - 3. When cable tray terminations to cable rack, install 16 mm<sup>2</sup> (6 AWG) bonding jumper between cable tray and cable rack pan.

**3.10 COMMUNICATIONS RACEWAY GROUNDING**

- A. Conduit: Use insulated 16 mm<sup>2</sup> (6 AWG) bonding jumpers to ground metallic conduit at each end and to bond at all intermediate metallic enclosures.
- B. Wireway: use insulated 16 mm<sup>2</sup> (6 AWG) bonding jumpers to ground or bond metallic wireway at each end at all intermediate metallic enclosures and across all section junctions.

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- C. Cable Tray Systems: Use insulated 16 mm<sup>2</sup> (6 AWG) bonding jumpers to ground cable tray to column-mounted building ground plates (pads) at each end and approximately every 16 meters (50 feet).

**3.11 GROUND RESISTANCE**

- A. Grounding system resistance to ground shall not exceed 5 ohms. Make necessary modifications or additions to the grounding electrode system for compliance without additional cost to the Government. Final tests shall assure that this requirement is met.
- B. Resistance of the grounding electrode system shall be measured using a four-terminal fall-of-potential method as defined in IEEE 81. Ground resistance measurements shall be made before the electrical distribution system is energized and shall be made in normally dry conditions not less than 48 hours after the last rainfall. Resistance measurements of separate grounding electrode systems shall be made before the systems are bonded together below grade. The combined resistance of separate systems may be used to meet the required resistance, but the specified number of electrodes must still be provided.
- C. Services at power company interface points shall comply with the power company ground resistance requirements.
- D. Below-grade connections shall be visually inspected by the Resident Engineer prior to backfilling. The Contractor shall notify the Resident Engineer 24 hours before the connections are ready for inspection.

**3.12 GROUND ROD INSTALLATION**

- A. Drive each rod vertically in the earth, not less than 3000 mm (10 feet) in depth.
- B. Where permanently concealed ground connections are required, make the connections by the exothermic process to form solid metal joints. Make accessible ground connections with mechanical pressure type ground connectors.
- C. Where rock prevents the driving of vertical ground rods, install angled ground rods or grounding electrodes in horizontal trenches to achieve the specified resistance.

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SECTION 27 05 28  
CABLE TRAYS FOR COMMUNICATIONS SYSTEMS

**PART 1 - GENERAL**

**1.1 REFERENCES**

- A. The publications listed below form a part of this Specification to the extent referenced. The publications are referred to within the text by the basic designation only.
- B. ASTM INTERNATIONAL (ASTM):
  - 1. ASTM A 1008/A 1008M (2010) Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability, Solution Hardened, and Bake Hardened
  - 2. ASTM A 123/A 123M (2009) Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
- C. NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)
  - 1. NEMA VE 2 (2006) Cable Tray Installation Guidelines
- D. NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)
  - 1. NFPA 70 (2011) National Electrical Code

**1.2 GENERAL REQUIREMENTS**

- A. Section 26 00 00 BASIC ELECTRICAL MATERIALS AND METHODS applies to work specified in this section.

**1.3 SUBMITTALS**

- A. SD-02 Shop Drawings:
  - 1. Fabrication Drawings.
  - 2. Installation Drawings.
- B. SD-03 Product Data:
  - 1. Submit manufacturer's product data for the following items:
    - a. Cable Trays.
    - b. Supports.
- C. SD-08 Manufacturer's Instructions:
  - 1. Submit Manufacturer's Instructions for cable trays in accordance with paragraph entitled "Manufacturer's Instructions," of this section.

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**1.4 QUALITY ASSURANCE**

- A. Comply with NEMA Standards Publication Number VE1, "Cable Tray Systems."
- B. Comply with NEC, as applicable to construction and installation of cable tray and cable channel systems (Article 392 NEC).
- C. Provide products that are UL-classified and labeled.

**PART 2 - PRODUCTS**

**2.1 CABLE TRAYS, GENERAL REQUIREMENTS**

- A. Cable tray systems shall be of indicated types, sizes, and NEMA classes and shall be complete with manufacturer's recommended covers, barrier strips, dropouts, fittings, conduit adaptors, hold-down devices, grommets, and blind ends as required and indicated.
- B. Cable tray products shall have rounded edges and smooth surfaces.

**2.2 MATERIALS AND FINISHES FOR WIRE BASKET CABLE TRAY**

- A. Cable Tray Materials: Select one of the following:
  - 1. Carbon steel wire, ASTM A 510, Grade 1008. Wire welded, bent and surface treated after manufacture.
- B. Cable Tray Finishes:
  - 1. Finish for carbon steel wire after welding and bending of mesh; select one of the following:
    - a. Electrodeposited Zinc Plating: ASTM B 633, Type III, SC-1.
- C. Cable tray shall consist of continuous, rigid, welded steel wire mesh cable management system, to allow continuous ventilation of cables and maximum dissipation of heat, with UL Classified splices where tray acts as equipment grounding conductor. Wire mesh cable tray shall have continuous welded top side wire to protect cable insulation and installers.
  - 1. Cable tray shall only consist of radial bends allowing free-forming cable bends of
- D. Provide splices, supports, and other fittings necessary for a complete, continuously grounded system.

**2.3 SIZES AND CONFIGURATIONS FOR WIRE BASKET CABLE TRAY**

- A. Wire mesh: 2 inches by 4 inches (50 x 100 mm).
- B. Cable tray depth: 4 inches (50 mm).
- C. Cable tray width: 6 inches (150 mm).

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- D. Wire Diameter: Patented design includes varying wire sizes to meet application load requirements; to optimize tray strength; and to allow tray to remain lightweight (5 mm thickness minimum).

**2.4 MATERIALS AND FINISHES FOR CABLE RUNWAY**

- A. Cable Trays, Fittings, and Accessories:
1. Tubular Steel - 1-1/2" x .375".
  2. 1/2" x 1" steel channel welded rungs.
  3. UL Classified as Equipment Grounding Conductor.
  4. Material: ASTM A513 Steel Tube.
  5. Finish: Flat Black, powder coated.

**2.5 SIZES AND CONFIGURATIONS FOR CABLE RUNWAY**

- A. Ladder-Type Rail Spacing:
1. Use 12" wide tray over data racks.
- B. Ladder-Type Trays Cross-Rung Spacing: 9 inches o.c.
- C. Ladder-Type Trays Nominal Side-Rail Height: 1-1/2 inches.

**2.6 FASTENERS FOR SUPPORTS**

- A. Fasteners to connect cable tray supports to the building structure shall be as follows:
1. Expansion Anchors: Carbon steel wedge or sleeve type.
  2. Toggle Bolts: All-steel springhead type.
  3. Powder-Driven Threaded Studs: Heat-treated steel, designed specifically for the intended service.

**2.7 CABLE TRAY RUNWAY ACCESSORIES**

- A. Cable Drop-Outs or Waterfalls:
1. Sizes to cable tray width for cable bundle distribution.
  2. Category 6 compliant (meeting minimum bend radius).
  3. Same material and finish as cable tray.
- B. Fittings: Pre-manufactured tees, crosses, risers, elbows, and other fittings of same materials and finishes as cable tray.
- C. Conduit to Cable Tray Adaptors: U clamp type, of same material and finish as cable tray.

**2.8 FIRESTOPPING**

- A. General: Materials shall be UL listed and labeled and FM approved for fire and smoke ratings consistent with penetrated barriers, per Division 07 and Division 26 Section "Firestopping."
1. Sleeves per Section "Firestopping."

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**2.9 WARNING SIGNS**

- A. Lettering: 1-1/2 inch high, black on yellow background with legend  
"WARNING! NOT TO BE USED AS WALKWAY, LADDER, OR SUPPORT FOR LADDERS OR  
PERSONNEL."
- B. Materials and Fastening: Conform to Division 26 Section "Electrical  
Identification."

**PART 3 - EXECUTION**

**3.1 INSTALLATION OF CABLE TRAY SYSTEMS**

- A. Install cable runway for installation in all telecommunications rooms  
to support communications cabling above racks and equipment boards and  
for vertical support.
- B. Install wire basket cable tray for horizontal cable runs in  
interstitial space to support communications cabling.
- C. Cable tray shall be trapeze supported on both sides.
- D. Support cable tray independently from the building structural  
components.
- E. Fasten cable tray supports to building structure:
  - 1. Design each fastener and support to carry load indicated by seismic  
requirements.
  - 2. Construct supports from channel members, threaded rods, and other  
appurtenances furnished by cable tray manufacturer. Arrange  
supports in trapeze or wall-bracket form as required by application.
  - 3. Support bus assembly to prevent twisting from eccentric loading.
  - 4. Manufacture center-hung support, designed for 60 percent versus 40  
percent eccentric loading condition, with a safety factor of 3.
  - 5. Locate and install supports according to NEMA VE 2.
  - 6. Conform to manufacturer's recommendations for selection and  
installation of supports.
  - 7. Strength of each support including fastenings to the structure shall  
be adequate to carry present and future load, multiplied by a safety  
factor of at least four, or 200 lbs., whichever is greater.
  - 8. Support Locations: Locate supports in accordance with the  
recommendations of NEMA Standard VE 2.
- F. Support at Connections to Equipment: Where cable trays connect to  
equipment, provide flanged fittings fastened to the tray and to the  
equipment. Support the tray separately. Do not carry the weight of  
the tray on the equipment enclosure.

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- G. Thermal Contraction and Expansion: Install expansion connectors in cable tray runs that exceed the following length:
  - 1. Spacings for expansion connectors shall not exceed maximums indicated in NEMA Standard VE 2.
  - 2. Gap Settings for expansion connectors shall be in accordance with NEMA Standard VE 2.
- H. Locate cable tray above piping except as required for tray accessibility and as otherwise shown on Drawings.
- I. Firestopping: Where cable trays penetrate fire and smoke barriers including walls, partitions, floors, and ceilings, install firestopping at penetrations after cables are installed per Division 26 Section "Sleeves and Fire-Rated Cable Assemblies."
- J. Coordinate firestopping locations to align with cable tray installation pathway.
- K. Working Space: Coordinate and install cable trays with sufficient space to permit access for installing cables. Leave six (6) inches clear above tray while not impeding upon ceiling heights.
- L. Provide cable dropouts:
  - 1. To properly support cable distribution bundles exiting bottom or side of tray.
  - 2. To allow change in elevation of tray.
  - 3. To enter/exit sleeves in partition walls.
  - 4. At data racks and equipment boards (multiple dropouts as required to enter each cable entrance).

**3.2 WARNING SIGNS**

- A. After installation of cable trays is completed, install warning signs, on or in proximity to cable trays, where easily seen by occupants of space.

**3.3 MANUFACTURER'S INSTRUCTIONS**

- A. Submit manufacturer's instructions for Cable Trays including special provisions required to install equipment components and system packages. Detail impedances, hazards, and safety precautions.

**3.4 INSTALLATION DRAWINGS**

- A. Thirty (30) calendar days prior to shipment, submit installation drawings to the Contracting Officer for approval. Coordinate drawings with all other work in the immediate area that could come in conflict with the installation. Include layout of cable tray work and details

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of both horizontal and vertical supports as specified in paragraph entitled "Supports" of this section.

**3.5 GROUNDING**

- A. Properly grounded cable trays by means of a low-resistance conductor of sufficient capacity, but in no case smaller than No. 1/0 AWG copper. Bond grounding conductor to cable-tray sections and fittings by compatible bolted connections. Consider cable tray sections in tandem assembly as having electrical continuity when these sections are bonded with appropriate high-strength bolts. Provide permanent and continuous effective grounding with an impedance sufficiently low to limit the potential above ground and to facilitate operation of overcurrent devices in the circuit. Provide grounding and bonding of cable trays in accordance with NFPA 70.

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**SECTION 27 05 33**  
**RACEWAYS AND BOXES FOR COMMUNICATIONS SYSTEMS**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

- A. This section specifies the furnishing, installation, and connection of conduit, fittings, and boxes to form complete, coordinated, raceway systems. Raceways are required for all communications cabling unless shown or specified otherwise.
- B. Definitions: The term conduit, as used in this specification, shall mean any or all of the raceway types specified.

**1.2 RELATED WORK**

- A. Bedding of conduits: Section 31 20 00, EARTH MOVING.
- B. Mounting board for communication closets: Section 06 10 00, ROUGH CARPENTRY.
- C. Sealing around penetrations to maintain the integrity of fire rated construction: Section 07 84 00, FIRESTOPPING.
- D. Fabrications for the deflection of water away from the building envelope at penetrations: Section 07 60 00, FLASHING AND SHEET METAL.
- E. Sealing around conduit penetrations through the building envelope to prevent moisture migration into the building: Section 07 92 00, JOINT SEALANTS.
- F. Identification and painting of conduit and other devices: Section 09 91 00, PAINTING.
- G. General electrical requirements and items that is common to more than one section of Division 27: Section 27 05 11, REQUIREMENTS FOR COMMUNICATIONS INSTALLATIONS.
- H. Requirements for personnel safety and to provide a low impedance path for possible ground fault currents: Section 27 05 26, GROUNDING AND BONDING FOR COMMUNICATIONS SYSTEMS.

**1.3 SUBMITTALS**

In accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES, furnish the following:

- A. Shop Drawings:
  - 1. Size and location of panels and pull boxes.
  - 2. Layout of required conduit penetrations through structural elements.
  - 3. The specific item proposed and its area of application shall be identified on the catalog cuts.
- B. Certification: Prior to final inspection, deliver to the Resident Engineer four copies of the certification that the material is in

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accordance with the drawings and specifications and has been properly installed.

**1.4 APPLICABLE PUBLICATIONS**

- A. Publications listed below (including amendments, addenda, revisions, supplements and errata) form a part of this specification to the extent referenced. Publications are referenced in the text by the basic designation only.
- B. National Fire Protection Association (NFPA):
  - 70-05 .....National Electrical Code (NEC)
- C. Underwriters Laboratories, Inc. (UL):
  - 1-03 .....Flexible Metal Conduit
  - 5-01 .....Surface Metal Raceway and Fittings
  - 6-03 .....Rigid Metal Conduit
  - 50-03 .....Enclosures for Electrical Equipment
  - 360-03 .....Liquid-Tight Flexible Steel Conduit
  - 467-01 .....Grounding and Bonding Equipment
  - 514A-01 .....Metallic Outlet Boxes
  - 514B-02 .....Fittings for Cable and Conduit
  - 514C-05 .....Nonmetallic Outlet Boxes, Flush-Device Boxes and Covers
  - 651-02 .....Schedule 40 and 80 Rigid PVC Conduit
  - 651A-03 .....Type EB and A Rigid PVC Conduit and HDPE Conduit
  - 797-03 .....Electrical Metallic Tubing
  - 1242-00 .....Intermediate Metal Conduit
- D. National Electrical Manufacturers Association (NEMA):
  - TC-3-04 .....PVC Fittings for Use with Rigid PVC Conduit and Tubing
  - FB1-03 .....Fittings, Cast Metal Boxes and Conduit Bodies for Conduit, Electrical Metallic Tubing and Cable
- E. ICC-ES AC01 - Acceptance Criteria for Expansion Anchors in Masonry Elements; 2009
- F. ICC-ES AC106 - Acceptance Criteria for Predrilled Fasteners (Screw Anchors) in Masonry Elements; 2006
- G. ICC-ES AC193 - Acceptance Criteria for Mechanical Anchors in Concrete Elements; 2010
- H. ICC-ES AC308 - Acceptance Criteria for Post-Installed Adhesive Anchors in Concrete Elements; 2009.
- I. ICC-ES AC70 - Acceptance Criteria for Fasteners Power-driven into Concrete, Steel and Masonry Elements; 2010



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- J. NECA 1 - Standard Practices for Good Workmanship in Electrical Contracting; National Electrical Contractors Association; 2006
- K. NFPA 70 - National Electrical Code; National Fire Protection Association; 2008

**PART 2 - PRODUCTS**

**2.1 MATERIAL**

- A. Conduit Size: In accordance with the NEC, but not less than 25 mm (1 inch) unless otherwise shown.
- B. Conduit:
  - 1. Rigid galvanized steel: Shall Conform to UL 6, ANSI C80.1.
  - 2. Rigid aluminum: Shall Conform to UL 6A, ANSI C80.5.
  - 3. Rigid intermediate steel conduit (IMC): Shall Conform to UL 1242, ANSI C80.6.
  - 4. Electrical metallic tubing (EMT): Shall Conform to UL 797, ANSI C80.3. Maximum size not to exceed 105 mm (4 inch) and shall be permitted only with cable rated 600 volts or less.
  - 5. Flexible galvanized steel conduit: Shall Conform to UL 1.
  - 6. Liquid-tight flexible metal conduit: Shall Conform to UL 360.
  - 7. Direct burial plastic conduit: Shall conform to UL 651 and UL 651A, heavy wall PVC or high density polyethylene (PE).
  - 8. Surface metal raceway: Shall Conform to UL 5.
- C. Conduit Fittings:
  - 1. Rigid steel and IMC conduit fittings:
    - a. Fittings shall meet the requirements of UL 514B and ANSI/ NEMA FB1.
    - b. Standard threaded couplings, locknuts, bushings, and elbows: Only steel or malleable iron materials are acceptable. Integral retractable type IMC couplings are also acceptable.
    - c. Locknuts: Bonding type with sharp edges for digging into the metal wall of an enclosure.
    - d. Bushings: Metallic insulating type, consisting of an insulating insert molded or locked into the metallic body of the fitting. Bushings made entirely of metal or nonmetallic material are not permitted.
    - e. Erickson (union-type) and set screw type couplings: Approved for use in concrete are permitted for use to complete a conduit run where conduit is installed in concrete. Use set screws of case hardened steel with hex head and cup point to firmly seat in conduit wall for positive ground. Tightening of set screws with pliers is prohibited.

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- f. Sealing fittings: Threaded cast iron type. Use continuous drain type sealing fittings to prevent passage of water vapor. In concealed work, install fittings in flush steel boxes with blank cover plates having the same finishes as that of other electrical plates in the room.
- 2. Rigid aluminum conduit fittings:
  - a. Standard threaded couplings, locknuts, bushings, and elbows: Malleable iron, steel or aluminum alloy materials; Zinc or cadmium plate iron or steel fittings. Aluminum fittings containing more than 0.4 percent copper are prohibited.
  - b. Locknuts and bushings: As specified for rigid steel and IMC conduit.
  - c. Set screw fittings: Not permitted for use with aluminum conduit.
- 3. Electrical metallic tubing fittings:
  - a. Fittings shall meet the requirements of UL 514B and ANSI/ NEMA FB1.
  - b. Only steel or malleable iron materials are acceptable.
  - c. Couplings and connectors: Concrete tight and rain tight, with connectors having insulated throats. Use gland and ring compression type couplings and connectors for conduit sizes 50 mm (2 inches) and smaller. Use set screw type couplings with four set screws each for conduit sizes over 50 mm (2 inches). Use set screws of case-hardened steel with hex head and cup point to firmly seat in wall of conduit for positive grounding.
  - d. Indent type connectors or couplings are prohibited.
  - e. Die-cast or pressure-cast zinc-alloy fittings or fittings made of "pot metal" are prohibited.
- 4. Flexible steel conduit fittings:
  - a. Conform to UL 514B. Only steel or malleable iron materials are acceptable.
  - b. Clamp type, with insulated throat.
- 5. Liquid-tight flexible metal conduit fittings:
  - a. Fittings shall meet the requirements of UL 514B and ANSI/ NEMA FB1.
  - b. Only steel or malleable iron materials are acceptable.
  - c. Fittings must incorporate a threaded grounding cone, a steel or plastic compression ring, and a gland for tightening. Connectors shall have insulated throats.
- 6. Direct burial plastic conduit fittings:
  - a. Fittings shall meet the requirements of UL 514C and NEMA TC3.

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- b. As recommended by the conduit manufacturer.
- 7. Surface metal raceway fittings: As recommended by the raceway manufacturer.
- 8. Expansion and deflection couplings:
  - a. Conform to UL 467 and UL 514B.
  - b. Accommodate, 19 mm (0.75 inch) deflection, expansion, or contraction in any direction, and allow 30 degree angular deflections.
  - c. Include internal flexible metal braid sized to guarantee conduit ground continuity and fault currents in accordance with UL 467, and the NEC code tables for ground conductors.
  - d. Jacket: Flexible, corrosion-resistant, watertight, moisture and heat resistant molded rubber material with stainless steel jacket clamps.
- D. Conduit Supports:
  - 1. Parts and hardware: Zinc-coat or provide equivalent corrosion protection.
  - 2. Individual Conduit Hangers: Designed for the purpose, having a pre-assembled closure bolt and nut, and provisions for receiving a hanger rod.
  - 3. Multiple conduit (trapeze) hangers: Not less than 38 mm by 38 mm (1-1/2 by 1-1/2 inch), 12 gage steel, cold formed, lipped channels; with not less than 9 mm (3/8 inch) diameter steel hanger rods.
  - 4. Solid Masonry and Concrete Anchors: Self-drilling expansion shields, or machine bolt expansion.
- E. Outlet, Junction, and Pull Boxes:
  - 1. UL-50 and UL-514A.
  - 2. Cast metal where required by the NEC or shown, and equipped with rustproof boxes.
  - 3. Sheet metal boxes: Galvanized steel, except where otherwise shown.
  - 4. Flush mounted wall or ceiling boxes shall be installed with raised covers so that front face of raised cover is flush with the wall. Surface mounted wall or ceiling boxes shall be installed with surface style flat or raised covers.
- F. Wireways: Equip with hinged covers, except where removable covers are shown.
- G. Warning Tape: Standard, 4-Mil polyethylene 76 mm (3 inch) wide tape detectable type, red with black letters, and imprinted with "CAUTION BURIED COMMUNICATIONS CABLE BELOW".

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**PART 3 - EXECUTION**

**3.1 PENETRATIONS**

**A. Cutting or Holes:**

1. Locate holes in advance where they are proposed in the structural sections such as ribs or beams. Obtain the approval of the Resident Engineer prior to drilling through structural sections.
2. Cut holes through concrete and masonry in new and existing structures with a diamond core drill or concrete saw. Pneumatic hammer, impact electric, hand or manual hammer type drills are not allowed, except where permitted by the Resident Engineer as required by limited working space.

**B. Fire Stop:** Where conduits, wireways, and other communications raceways pass through fire partitions, fire walls, smoke partitions, or floors, install a fire stop that provides an effective barrier against the spread of fire, smoke and gases as specified in Section 07 84 00, FIRESTOPPING, with rock wool fiber or silicone foam sealant only. Completely fill and seal clearances between raceways and openings with the fire stop material.

**C. Waterproofing:** At floor, exterior wall, and roof conduit penetrations, completely seal clearances around the conduit and make watertight as specified in Section 07 92 00, JOINT SEALANTS.

**3.2 INSTALLATION, GENERAL**

**A. Install conduit as follows:**

1. In complete runs before pulling in cables or wires.
2. Flattened, dented, or deformed conduit is not permitted. Remove and replace the damaged conduits with new undamaged material.
3. Assure conduit installation does not encroach into the ceiling height head room, walkways, or doorways.
4. Cut square with a hacksaw, ream, remove burrs, and draw up tight.
5. Mechanically continuous.
6. Independently support conduit at 8'0" on center. Do not use other supports i.e., (suspended ceilings, suspended ceiling supporting members, lighting fixtures, conduits, mechanical piping, or mechanical ducts).
7. Support within 300 mm (1 foot) of changes of direction, and within 300 mm (1 foot) of each enclosure to which connected.
8. Close ends of empty conduit with plugs or caps at the rough-in stage to prevent entry of debris, until wires are pulled in.
9. Conduit installations under fume and vent hoods are prohibited.

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10. Secure conduits to cabinets, junction boxes, pull boxes and outlet boxes with bonding type locknuts. For rigid and IMC conduit installations, provide a locknut on the inside of the enclosure, made up wrench tight. Do not make conduit connections to junction box covers.
  11. Flashing of penetrations of the roof membrane is specified in Section 07 60 00, FLASHING AND SHEET METAL.
  12. Do not use aluminum conduits in wet locations.
  13. Unless otherwise indicated on the drawings or specified herein, all conduits shall be installed concealed within finished walls, floors and ceilings.
- B. Conduit Bends:
1. Make bends with standard conduit bending machines.
  2. Conduit hickey may be used for slight offsets, and for straightening stubbed out conduits.
  3. Bending of conduits with a pipe tee or vise is prohibited.
- C. Layout and Homeruns:
2. Deviations: Make only where necessary to avoid interferences and only after drawings showing the proposed deviations have been submitted approved by the Resident Engineer.

**3.3 CONCEALED WORK INSTALLATION**

- A. In Concrete:
1. Conduit: Rigid steel, IMC or EMT. Do not install EMT in concrete slabs that are in contact with soil, gravel or vapor barriers.
  2. Align and run conduit in direct lines.
  3. Install conduit through concrete beams only when the following occurs:
    - a. Where shown on the structural drawings.
    - b. As approved by the COTR prior to construction, and after submittal of drawing showing location, size, and position of each penetration.
  4. Installation of conduit in concrete that is less than 75 mm (3 inches) thick is prohibited.
    - a. Conduit outside diameter larger than 1/3 of the slab thickness is prohibited.
    - b. Space between conduits in slabs: Approximately six conduit diameters apart, except one conduit diameter at conduit crossings.
    - c. Install conduits approximately in the center of the slab so that there will be a minimum of 19 mm (3/4 inch) of concrete around the conduits.

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5. Make couplings and connections watertight. Use thread compounds that are UL approved conductive type to insure low resistance ground continuity through the conduits. Tightening set screws with pliers is prohibited.

**B. Furred or Suspended Ceilings and in Walls:**

1. Conduit for conductors 600 volts and below:
  - a. Rigid steel, IMC, rigid aluminum, or EMT. Different type conduits mixed indiscriminately in the same system is prohibited.
2. Align and run conduit parallel or perpendicular to the building lines.
3. Tightening set screws with pliers is prohibited.

**3.4 EXPOSED WORK INSTALLATION**

- A. Unless otherwise indicated on the drawings, exposed conduit is only permitted in mechanical and electrical rooms.
- B. Conduit for conductors above 600 volts:
  1. Rigid steel or rigid aluminum.
  2. Aluminum conduit mixed indiscriminately with other types in the same system is prohibited.
- C. Conduit for Conductors 600 volts and below:
  1. Rigid steel, IMC, rigid aluminum, or EMT. Different type of conduits mixed indiscriminately in the system is prohibited.
- D. Align and run conduit parallel or perpendicular to the building lines.
- E. Install horizontal runs close to the ceiling or beams and secure with conduit straps.
- F. Support horizontal or vertical runs at not over 2400 mm (eight foot) intervals.
- G. Surface metal raceways: Use only where shown.
- H. Painting:
  1. Paint exposed conduit as specified in Section 09 91 00, PAINTING.
  2. Refer to Section 09 91 00, PAINTING for preparation, paint type, and exact color. Provide legends where conduits pass through walls and floors and at maximum 6000 mm (20 foot) intervals in between.

**3.5 EXPANSION JOINTS**

- A. Conduits 75 mm (3 inches) and larger, that are secured to the building structure on opposite sides of a building expansion joint, require expansion and deflection couplings. Install the couplings in accordance with the manufacturer's recommendations.
- B. Provide conduits smaller than 75 mm (3 inches) with junction boxes on both sides of the expansion joint. Connect conduits to junction boxes with sufficient slack of flexible conduit to produce 125 mm (5 inch)

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vertical drop midway between the ends. Flexible conduit shall have a copper green ground bonding jumper installed. In lieu of this flexible conduit, expansion and deflection couplings as specified above for 375 mm (15 inches) and larger conduits are acceptable.

- C. Install expansion and deflection couplings where shown.
- D. Seismic Areas: In seismic areas, provide conduits rigidly secured to the building structure on opposite sides of a building expansion joint with junction boxes on both sides of the joint. Connect conduits to junction boxes with 375 mm (15 inches) of slack flexible conduit. Flexible conduit shall have a copper green ground bonding jumper installed.

**3.6 CONDUIT SUPPORTS, INSTALLATION**

- A. Safe working load shall not exceed 1/4 of proof test load of fastening devices.
- B. Use pipe straps or individual conduit hangers for supporting individual conduits. Maximum distance between supports is 2.5 m (8 foot) on center.
- C. Support multiple conduit runs with trapeze hangers. Use trapeze hangers that are designed to support a load equal to or greater than the sum of the weights of the conduits, wires, hanger itself, and 90 kg (200 pounds). Attach each conduit with U-bolts or other approved fasteners.
- D. Support conduit independently of junction boxes, pull boxes, fixtures, suspended ceiling T-bars, angle supports, and similar items.
- E. Fasteners and Supports in Solid Masonry and Concrete:
  - 1. New Construction: Use steel or malleable iron concrete inserts set in place prior to placing the concrete.
  - 2. Existing Construction:
    - a. Steel expansion anchors not less than 6 mm (1/4 inch) bolt size and not less than 28 mm (1-1/8 inch) embedment.
    - b. Use vibration and shock resistant anchors and fasteners for attaching to concrete ceilings.
- F. Hollow Masonry: Toggle bolts are permitted.
- G. Bolts supported only by plaster or gypsum wallboard are not acceptable.
- H. Metal Structures: Use machine screw fasteners or other devices specifically designed and approved for the application.
- I. Attachment by wood plugs, rawl plug, plastic, lead or soft metal anchors, or wood blocking and bolts supported only by plaster is prohibited.
- J. Chain, wire, or perforated strap shall not be used to support or fasten conduit.
- K. Spring steel type supports or fasteners are prohibited for all uses except: Horizontal and vertical supports/fasteners within walls.

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- L. Vertical Supports: Vertical conduit runs shall have riser clamps and supports in accordance with the NEC and as shown. Provide supports for cable and wire with fittings that include internal wedges and retaining collars.

**3.7 BOX INSTALLATION**

- A. Boxes for Concealed Conduits:
  - 1. Flush mounted.
  - 2. Provide raised covers for boxes to suit the wall or ceiling, construction and finish.
- B. In addition to boxes shown, install additional boxes where needed to prevent damage to cables and wires during pulling in operations.
- C. Remove only knockouts as required and plug unused openings. Use threaded plugs for cast metal boxes and snap-in metal covers for sheet metal boxes.
- D. Stencil or install phenolic nameplates on covers of the boxes identified on riser diagrams; for example "SIG-FA JB No. 1".

**3.8 COMMUNICATION SYSTEM CONDUIT**

- A. Install the communication raceway system as shown on drawings.
- B. Minimum conduit size of 25 mm (1 inch), but not less than the size shown on the drawings.
- C. All conduit ends shall be equipped with insulated bushings.
- D. All 100 mm (four inch) conduits within buildings shall include pull boxes after every two 90 degree bends. Size boxes per TIA 569C.
- E. Vertical conduits/sleeves through closets floors shall terminate not less than 75 mm (3 inches) below the floor and not less than 75 mm (3 inches) below the ceiling of the floor below.
- F. Terminate conduit runs to/from a backboard in a closet or interstitial space at the top or bottom of the backboard. Conduits shall enter communication closets next to the wall and be flush with the backboard.
- G. Where drilling is necessary for vertical conduits, locate holes so as not to affect structural sections such as ribs or beams.
- H. All empty conduits located in communication closets or on backboards shall be sealed with a standard non-hardening putty compound to prevent the entrance of moisture and gases and to meet fire resistance requirements.
- I. Conduit runs shall contain no more than two quarter turns (90 degree bends) between pull boxes/backboards. Minimum radius of communication conduit bends shall be as follows (special long radius):



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Sizes of Conduit Trade Size	Radius of Conduit Bends mm, Inches
1	230 (9)
1-1/4	350 (14)
1-1/2	430 (17)
2	525 (21)
2-1/2	635 (25)
3	775 (31)
3-1/2	900 (36)
4	1125 (45)

- J. Furnish and install 19 mm (3/4 inch) thick fire retardant plywood specified in Section 06 10 00, ROUGH CARPENTRY on walls of communication closets. Mount the plywood with the bottom edge 300 mm (one foot) above the finished floor.
- K. Furnish and pull wire in all empty conduits. (Sleeves through floor are exceptions).

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SECTION 27 10 00  
STRUCTURED CABLING

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This section specifies the furnishing, installation, and connection of the structured cabling system to provide a comprehensive telecommunications infrastructure.

1.2 RELATED WORK

- A. Sealing around penetrations to maintain the integrity of time rated construction: Section 07 84 00, FIRESTOPPING.
- B. Conduits for cables and wiring: Section 27 05 33, RACEWAYS AND BOXES FOR COMMUNICATIONS SYSTEMS.
- C. Requirements for personnel safety and to provide a low impedance path for possible ground fault currents: Section 27 05 26, GROUNDING AND BONDING FOR COMMUNICATIONS SYSTEMS.

1.3 SUBMITTALS

- A. In accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES, furnish the following:
1. Manufacturer's Literature and Data: Showing each cable type and rating.
  2. Certificates: Two weeks prior to final inspection, deliver to the COTR four copies of the certification that the material is in accordance with the drawings and specifications and has been properly installed.

1.4 APPLICABLE PUBLICATIONS

- A. Publications listed below (including amendments, addenda, revisions, supplements and errata) form a part of this specification to the extent referenced. Publications are reference in the text by the basic designation only.
- B. American Society of Testing Material (ASTM):
- D2301-04 .....Standard Specification for Vinyl Chloride  
Plastic Pressure Sensitive Electrical Insulating  
Tape
- C. Federal Specifications (Fed. Spec.):
- A-A-59544-00 .....Cable and Wire, Electrical (Power, Fixed  
Installation)
- D. National Fire Protection Association (NFPA):
- 70-05 .....National Electrical Code (NEC)
- E. Underwriters Laboratories, Inc. (UL):
- 44-02 .....Thermoset-Insulated Wires and Cables

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83-03 .....	Thermoplastic-Insulated Wires and Cables
467-01 .....	Electrical Grounding and Bonding Equipment
486A-01 .....	Wire Connectors and Soldering Lugs for Use with Copper Conductors
486C-02 .....	Splicing Wire Connectors
486D-02 .....	Insulated Wire Connector Systems for Underground Use or in Damp or Wet Locations
486E-00 .....	Equipment Wiring Terminals for Use with Aluminum and/or Copper Conductors
493-01 .....	Thermoplastic-Insulated Underground Feeder and Branch Circuit Cable
514B-02 .....	Fittings for Cable and Conduit
1479-03 .....	Fire Tests of Through-Penetration Fire Stops

**PART 2 - PRODUCTS**

**2.1 CONTROL WIRING**

- A. Unless otherwise specified in other sections of these specifications, control wiring shall be as specified for power and lighting wiring, except the minimum size shall be not less than No. 14 AWG.
- B. Control wiring shall be large enough so that the voltage drop under inrush conditions does not adversely affect operation of the controls.

**2.2 COMMUNICATION AND SIGNAL WIRING**

- A. Shall conform to the recommendations of the manufacturers of the communication and signal systems; however, not less than what is shown.
- B. Wiring shown is for typical systems. Provide wiring as required for the systems being furnished.
- C. Multi-conductor cables shall have the conductors color coded.

**2.3 WIRE LUBRICATING COMPOUND**

- A. Suitable for the wire insulation and conduit it is used with, and shall not harden or become adhesive.
- B. Shall not be used on wire for isolated type electrical power systems.

**PART 3 - EXECUTION**

**3.1 INSTALLATION, GENERAL**

- A. Install all wiring in raceway systems.
- B. Seal cable and wire entering a building from underground, between the wire and conduit where the cable exits the conduit, with a non-hardening approved compound.
- C. Wire Pulling:
  - 1. Provide installation equipment that will prevent the cutting or abrasion of insulation during pulling of cables.
  - 2. Use ropes made of nonmetallic material for pulling feeders.

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3. Attach pulling lines for feeders by means of either woven basket grips or pulling eyes attached directly to the conductors, as approved by the Resident Engineer.
4. Pull in multiple cables together in a single conduit.

**3.2 CONTROL, COMMUNICATION AND SIGNAL WIRING INSTALLATION**

- A. Unless otherwise specified in other sections, install wiring and connect to equipment/devices to perform the required functions as shown and specified.
- B. Except where otherwise required, install a separate power supply circuit for each system so that malfunctions in any system will not affect other systems.
- C. Where separate power supply circuits are not shown, connect the systems to the nearest panelboards of suitable voltages, which are intended to supply such systems and have suitable spare circuit breakers or space for installation.
- D. Install a red warning indicator on the handle of the branch circuit breaker for the power supply circuit for each system to prevent accidental de-energizing of the systems.
- E. System voltages shall be 120 volts or lower where shown on the drawings or as required by the NEC.

**3.3 CONTROL, COMMUNICATION AND SIGNAL SYSTEM IDENTIFICATION**

- A. Install a permanent wire marker on each wire at each termination.
- B. Identifying numbers and letters on the wire markers shall correspond to those on the wiring diagrams used for installing the systems.
- C. Wire markers shall retain their markings after cleaning.
- D. In each manhole and handhole, install embossed brass tags to identify the system served and function.

**3.4 EXISTING WIRING**

Unless specifically indicated on the plans, existing wiring shall not be reused for the new installation. Only wiring that conforms to the specifications and applicable codes may be reused. If existing wiring does not meet these requirements, existing wiring may not be reused and new wires shall be installed.

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SECTION 27 11 00  
COMMUNICATIONS EQUIPMENT ROOM FITTINGS

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This Section specifies the furnishing, installing, certification, testing, and guaranty of a complete and operating Voice and Digital Cable Distribution System (here-in-after referred to as "*the System*"), and associated equipment and hardware to be installed in the VA Medical Center here-in-after referred to as "*the Facility*". The System shall include, but not be limited to: equipment cabinets, interface enclosures, and relay racks; necessary combiners, traps, and filters; and necessary passive devices such as: splitters, couplers, cable "patch", "punch down", and cross-connector blocks or devices, voice and data distribution sub-systems, and associated hardware. The System shall additionally include, but not be limited to: telecommunication closets (TC); telecommunications outlets (TCO); copper and fiber optic, and analog radio frequency (RF) systems coaxial distribution cables, connectors, "patch" cables, and/or "break out" devices.
- B. The System shall be delivered free of engineering, manufacturing, installation, and functional defects. It shall be designed, engineered and installed for ease of operation, maintenance, and testing.
- C. The term "provide", as used herein, shall be defined as: designed, engineered, furnished, installed, certified, and tested, by the Contractor.
- D. The Voice and Digital and Analog Telecommunication Distribution Cable Equipment and System provides the media which voice and data information travels over and connects to the Telephone System which is defined as an Emergency Critical Care Communication System by the National Fire Protection Association (NFPA). Therefore, since the System connects to or extends the telephone system, the System's installation and operation shall adhere to all appropriate National, Government, and/or Local Life Safety and/or Support Codes, which ever are the more stringent for this Facility. At a minimum , the System shall be installed according to NFPA, Section 70, National Electrical Code (NEC), Article 517 and Chapter 7; NFPA, Section 99, Health Care Facilities, Chapter 3-4; NFPA, Section 101, Life Safety Code, Chapters 7, 12, and/or 13; Joint Commission on Accreditation of Health

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Care Organization (JCAHCO), Manual for Health Care Facilities, all necessary Life Safety and/or Support guidelines; this specification; and the original equipment manufacturer's (OEM) suggested installation design, recommendations, and instructions. The OEM and Contractor shall ensure that all management, sales, engineering, and installation personnel have read and understand the requirements of this specification before the System is designed, engineered, delivered, and provided.

- E. The VA Project Manager (PM) and/or if delegated, Resident Engineer (RE) are the approving authorities for all contractual and mechanical changes to the System. The Contractor is cautioned to obtain in writing, all approvals for system changes relating to the published contract specifications and drawings, from the PM and/or the RE before proceeding with the change.

F. System Performance:

1. At a minimum, the System shall be able to support the following voice and data and analog RF operations for Category 6 Certified Telecommunication Service:

a. Telecommunications Outlet (TCO):

1) Voice:

- a) Isolation (outlet-outlet): 24 dB.
- b) Impedance: 600 Ohms, balanced (BAL).
- c) Signal Level: 0 deciBel per mili-Volt (dBmV)  $\pm$  0.1 dBmV.
- d) System speed: 100 mBps, minimum.
- e) System data error: 10 to the -6 Bps, minimum.

2) Data:

- a) Isolation (outlet-outlet): 24 dB.
- b) Impedance: 600 Ohms, BAL.
- c) Signal Level: 0 dBmV  $\pm$  0.1 dBmV.
- d) System speed: 120 mBps, minimum.
- e) System data error: 10 to the -8 Bps, minimum.

3) Fiber optic:

- a) Isolation (outlet-outlet): 36 dB.
- b) Signal Level: 0 dBmV  $\pm$  0.1 dBmV.
- c) System speed: 540 mBps, minimum.
- d) System data error: 10 to the -6 bps, minimum.



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- 4) Analog RF Service:
- a) Broadcast or "off air" RF (or television) analog service is considered to be at RF (below 900 mHz in frequency bandwidth). Usually a RF television circuits require a single coaxial cable plant from the headend to each TC location.
  - b) Isolation (outlet-outlet): 14 dB.
  - c) Impedance: 75 Ohms, Unbalanced (UNBAL).
  - d) Signal Level: 10 dBmV  $\pm$  5.0 dBmV.
  - e) Bandwidth: 6.0 mHz per channel, fully loaded
- 5) Closed Circuit Analog Video Service: Analog video service is considered to be at baseband (below 100 mHz in frequency bandwidth). An analog video circuit requires a separate analog video from the audio connector. The following minimum operating parameters shall be capable over each installed analog video circuit:

Impedance	75 Ohm, unbalanced
Output Level	1.0 V peak to peak (P-P), for 87.5% depth of Modulation (Mod)
Diff Gain	$\pm 1$ dB at 87.5% Mod
Diff Phase	$\pm 1.5$ at 87.5% Mod
Signal to Noise (S/N) ratio	44 dB, minimum
Hum Modulation	-55 dB
Return Loss	-14 dB (or 1.5 Voltage Standing Wave Ratio [VSWR]), maximum
Isolation (outlet-outlet)	24 DB, MINIMUM
Bandwidth	6.0 mHz per channel, fully loaded, minimum

**1.2 RELATED WORK**

- A. Specification Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Specification Section 27 05 11, REQUIREMENTS FOR COMMUNICATIONS INSTALLATIONS.
- C. Specification Section 27 05 33, RACEWAYS AND BOXES FOR COMMUNICATIONS SYSTEMS.

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- D. Specification Section 27 10 00, STRUCTURED CABLING.
- E. Specification Section 26 27 26, WIRING DEVICES.
- F. Specification Section 27 05 26, GROUNDING AND BONDING FOR COMMUNICATIONS SYSTEMS.
- G. Specification Section 26 41 00, FACILITY LIGHTNING PROTECTION.
- H. Specification Section 27 51 16, PUBLIC ADDRESS AND MASS NOTIFICATION SYSTEMS. I. Specification Section 27 41 31, MASTER ANTENNA TV EQUIPMENT AND SYSTEMS.

**1.3 APPLICABLE PUBLICATIONS**

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in text by basic designation only. Except for a specific date given the issue in effect (including amendments, addenda, revisions, supplements, and errata) on the date the system's submittal is technically approved by VA, shall be enforced.
- B. National Fire Protection Association (NFPA):

70	NATIONAL ELECTRICAL CODE (NEC)
75	Protection of Electronic Computer/Data Processing Equipment
77	Recommended Practice on Static Electricity
	Standard for Health Care Facilities
101	Life Safety Code
1221	Emergency Services Communication Systems

- C. Underwriters Laboratories, Inc. (UL):

65	Wired Cabinets
96	Lightning Protection Components
96A	INSTALLATION REQUIREMENTS FOR LIGHTNING PROTECTION SYSTEMS
467	Grounding and Bonding Equipment
497/497A/497B	PROTECTORS FOR PAIRED CONDUCTORS/ COMMUNICATIONS CIRCUITS/DATA COMMUNICATIONS AND FIRE ALARM CIRCUITS
884	Underfloor Raceways and Fittings

- D. ANSI/EIA/TIA Publications:

568-C.1	Commercial Building Telecommunications Wiring Standard
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569-C	Commercial Building Standard for Telecommunications Pathways and Spaces
606B	ADMINISTRATION STANDARD FOR THE TELECOMMUNICATIONS INFRASTRUCTURE OF COMMERCIAL BUILDINGS
607B	Grounding and Bonding Requirements for Telecommunications in Commercial Buildings
758	Grounding and Bonding Requirements for Telecommunications in Commercial Buildings

- E. Lucent Technologies: Document 900-200-318 "Outside Plant Engineering Handbook".
- F. International Telecommunication Union - Telecommunication Standardization Sector (ITU-T).
- G. Federal Information Processing Standards (FIPS) Publications.
- H. Federal Communications Commission (FCC) Publications: Standards for telephone equipment and systems.
- I. United States Air Force: Technical Order 33K-1-100 Test Measurement and Diagnostic Equipment (TMDE) Interval Reference Guide.
- J. Joint Commission on Accreditation of Health Care Organization (JCAHO): Comprehensive Accreditation Manual for Hospitals.
- K. National and/or Government Life Safety Code(s): The more stringent of each listed code.

**1.4 QUALITY ASSURANCE**

- A. The authorized representative of the OEM, shall be responsible for the design, satisfactory total operation of the System, and its certification.
- B. The OEM shall meet the minimum requirements identified in Paragraph 2.1.A. Additionally, the Contractor shall have had experience with three or more installations of systems of comparable size and complexity with regards to coordinating, engineering, testing, certifying, supervising, training, and documentation. Identification of these installations shall be provided as a part of the submittal as identified in Paragraph 1.5.
- C. The System Contractor shall submit certified documentation that they have been an authorized distributor and service organization for the OEM for a minimum of three (3) years. The System Contractor shall be authorized by the OEM to certify and warranty the installed equipment.

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In addition, the OEM and System Contractor shall accept complete responsibility for the design, installation, certification, operation, and physical support for the System. This documentation, along with the System Contractor and OEM certification must be provided in writing as part of the Contractor's Technical Submittal.

- D. All equipment, cabling, terminating hardware, TCOs, and patch cords shall be sourced from the certifying OEM or at the OEM's direction, and support the System design, the OEM's quality control and validity of the OEM's warranty.
- E. The Contractor's Telecommunications Technicians assigned to the System shall be fully trained, qualified, and certified by the OEM on the engineering, installation, and testing of the System. The Contractor shall provide formal written evidence of current OEM certification(s) for the installer(s) as a part of the submittal or to the RE before being allowed to commence work on the System.

**1.5 SUBMITTALS**

- A. Provide submittals in accordance with Specification Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES. The RE shall retain one copy for review and approval.
  - 1. If the submittal is approved the RE shall retain one copy for Official Records and return three (3) copies to the Contractor.
  - 2. If the submittal is disapproved, three (3) copies will be returned to the Contractor with a written explanation attached that indicates the areas the submittal deviated from the System specifications. The RE shall retain one copy for Official Records.
- B. Environmental Requirements: Technical submittals shall confirm the environmental specifications for physical TC areas occupied by the System. These environmental specifications shall identify the requirements for initial and expanded system configurations for:
  - 1. Floor loading for batteries and cabinets.
  - 2. Minimum floor space and ceiling heights.
  - 3. Minimum size of doors for equipment passage.
  - 4. Power requirements: The Contractor shall provide the specific voltage, amperage, phases, and quantities of circuits required.
  - 5. Air conditioning, heating, and humidity requirements. The Contractor shall identify the ambient temperature and relative humidity operating ranges required preventing equipment damage.

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6. Air conditioning requirements (expressed in BTU per hour, based on adequate dissipation of generated heat to maintain required room and equipment standards).
  7. Proposed floor plan, based on the expanded system configuration of the bidder's proposed EPBX for this FACILITY.
  8. Conduit size requirement (between main TC, computer, and console rooms).
  9. Main trunk line and riser pathways, cable duct, and conduit requirements between each MTC, TC, and TCO.
- C. Documents: The submittal shall be separated into sections for each subsystem and shall contain the following:
1. Title page to include:
    - a. VA Medical Center.
    - b. Contractor's name, address, and telephone (including FAX) numbers.
    - c. Date of Submittal.
    - d. VA Project No.
  2. List containing a minimum of three locations of installations of similar size and complexity as identified herein. These locations shall contain the following:
    - a. Installation Location and Name.
    - b. Owner's or User's name, address, and telephone (including FAX) numbers.
    - c. Date of Project Start and Date of Final Acceptance by Owner.
    - d. System Project Number.
    - e. Brief (three paragraphs minimum) description of each system's function, operation, and installation.
  3. Narrative Description of the system.
  4. A List of the equipment to be furnished. The quantity, make, and model number of each item is required. Select the required equipment items quantities that will satisfy the needs of the system and edit between the // - //. Delete equipment items that are not required add additional items required, and renumber section as per system design. The following is the minimum equipment required by the system:

QUANTITY	UNIT
As required	Equipment (Radio Relay) Rack

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As required	Cross Connection (CCS) Systems
As required	Wire Management System/Equipment
As required	Telecommunications Outlets (TCO)
As Required	Distribution Cables
As required	TCO Connection Cables
As required	System Connectors
As required	Terminators
As required	Distribution Frames
As required	Telecommunications Closets (TC)
As required	Environmental Requirements
1 ea.	Installation Kit
As-required	Separate List Containing Each Equipment Spare(s)

5. Pictorial layouts of each MTC, IMTC, and RTCs; MCCS, IMCCS, VCCS, and HCCS termination cabinet(s), each distribution cabinet layout drawing, and TCO as each is expected to be installed and configured.
6. Equipment technical literature detailing the electrical and technical characteristics of each item of equipment to be furnished.
7. Engineering drawings of the System, showing calculated signal levels at the EPBX output, each input and output distribution point, proposed TCO values, and signal level at each TCO multipin, fiberoptic, and coaxial cable jack.
8. List of test equipment as per paragraph 1.5.D. below.
9. Letter certifying that the Contractor understands the requirements of the SAMPLES Paragraph 1.5.E.
10. Letter certifying that the Contractor understands the requirements of Section 3.2 concerning acceptance tests.

**D. Test Equipment List:**

1. The Contractor is responsible for furnishing all test equipment required to test the system in accordance with the parameters specified. Unless otherwise stated, the test equipment shall not be considered part of the system. The Contractor shall furnish test equipment of accuracy better than the parameters to be tested.

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2. The test equipment furnished by the Contractor shall have a calibration tag of an acceptable calibration service dated not more than 12 months prior to the test. As part of the submittal, a test equipment list shall be furnished that includes the make and model number of the following type of equipment as a minimum:
  - a. Signal Level Meter.
  - b. Volt-Ohm Meter.
  - c. Time Domain Reflectometer (TDR) with strip chart recorder (Data and Optical Measuring).
  - d. Bit Error Test Set (BERT).
  - e. Camera with a minimum of 60 pictures to include appropriate SD Card. A video camera in DVD format is an acceptable alternate.
- E. Samples: A sample of each of the following items shall be furnished to the RE for approval prior to installation.
  1. TCO Wall Outlet Box 4" x 4"x 2.5" with:
    - a. Two each telephone (or voice) rj45/rj11 jack installed.
    - b. Three each multi pin data rj45 jacks installed.
    - c. Cover Plate installed.
    - d. RF (F)/jack(s) installed.
  2. Data CCS patch panel, punch block or connection device with RJ45 connectors installed.
  3. Telephone CCS system with IDC connectors and cable terminal equipment installed.
  4. Fiber optic CCS patch panel or breakout box with cable management equipment and "ST" connectors installed.
  5. 610 mm (2 ft.) section of each copper cable to be used with cable sweep tags as specified in paragraph 2.4.H and connectors installed.
  6. 610 mm (2 ft.) section of each fiber optic cable to be used with cable sweep tags as specified in paragraph 2.4.H and connectors installed.
  7. 610 mm (2 ft.) section of each analog RF, video coaxial cable to be used with cable sweep tags as specified in paragraph 2.4.H and connectors installed.
  8. Analog RF patch panel or breakout box with cable management equipment and "F" connectors installed.

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**F. Certifications:**

1. Submit written certification from the OEM indicating that the proposed supervisor of the installation and the proposed provider of the contract maintenance are authorized representatives of the OEM. Include the individual's exact name and address and OEM credentials in the certification.
2. Submit written certification from the OEM that the wiring and connection diagrams meet National and/or Government Life Safety Guidelines, NFPA, NEC, UL, this specification, and JCAHCO requirements and instructions, requirements, recommendations, and guidance set forth by the OEM for the proper performance of the System as described herein. The VA will not approve any submittal without this certification.
3. Preacceptance Certification: This certification shall be made in accordance with the test procedure outlined in paragraph 3.2.B.

**G. Equipment Manuals:** Fifteen (15) working days prior to the scheduled acceptance test, the Contractor shall deliver four complete sets of commercial operation and maintenance manuals for each item of equipment furnished as part of the System to the RE. The manuals shall detail the theory of operation and shall include narrative descriptions, pictorial illustrations, block and schematic diagrams, and parts list.

**H. Record Wiring Diagrams:**

1. Fifteen (15) working days prior to the acceptance test, the Contractor shall deliver four complete sets of the Record Wiring Diagrams of the System to the RE. The diagrams shall show all inputs and outputs of electronic and passive equipment correctly identified according to the markers installed on the interconnecting cables, Equipment and room/area locations.
2. The Record Wiring Diagrams shall be in hard copy and two compact disk (CD) copies properly formatted to match the Facility's current operating version of Computer Aided Drafting (AutoCAD) system. The RE shall verify and inform the Contractor of the version of AutoCAD being used by the Facility.

**I. Surveys Required As A Part Of The Technical Submittal:** The Contractor shall provide the following surveys that depict various system features and capacities are required in addition to the on site survey requirements described herein. Each survey shall be in writing and



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contain the following information (the formats are suggestions and may be used for the initial Technical Submittal survey requirements), as a minimum:

1. Cable Distribution System Design Plan: A design plan for the entire cable distribution systems requirements shall be provided with this document. A specific cable count shall coincide with the total growth items as described herein. It is the Contractor's responsibility to provide the Systems entire cable requirements and engineer a distribution system requirement plan using the format of the following paragraph(s), at a minimum:
  - a. UTP (and/or STP) Requirements/Column Explanation:

Column	Explanation
FROM BUILDING	Identifies the building by number, title, or location, and main signal closet or intermediate signal closet cabling is provided from
BUILDING	Identifies the building by number, title, or location cabling is to be provided in
TO BUILDING IMC	Identifies building main terminal signal closet, by room number or location, to which cabling is provided too, in, and from
FLOOR	Identifies the floor by number (i.e. 1st, 2nd, etc.) cabling and TCOs are to be provided
TC ROOM NUMBER	Identifies the floor signal closet room, by room number, which cabling shall be provided
ROOM NUMBER	Identifies the room, by number, from which cabling and TCOs shall be provided
NUMBER OF CABLE PAIR	Identifies the number of cable pair required to be provided on each floor designated OR the number of cable pair (VA Owned) to be retained
NUMBER OF STRANDS USED/SPARE	Identifies the number of strands provided in each run

- b. Fiber Optic Cabling Requirements/Column Explanation:

Column	Explanation
FROM BUILDING	Identifies the building by number, title, or location, and main signal closet or intermediate signal closet cabling is provided from

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TO BUILDING IMC	Identifies building, by number, title, or location, to which cabling is provided
FLOOR	Identifies the floor by number (i.e. 1st, 2nd, etc.)
TC ROOM NUMBER	Identifies the room, by number, from which cabling shall be installed
NUMBER OF STRANDS	Identifies the number of strands in each run of fiber optic cable
INSTALLED METHOD	Identifies the method of installation in accordance with as designated herein
NOTES	Identifies a note number for a special feature or equipment
BUILDING MTC	Identifies the building by number or title

c. Analog RF Cabling Requirements/Column Explanation:

Column	Explanation
FLOOR	Identifies the floor by number (i.e. 1st, 2nd, etc.)
TC ROOM NUMBER	Identifies the room, by number, from which cabling shall be installed
TO FLOOR TC	Identifies building, by number or location, to which cabling is installed
NUMBER OF STRANDS	Identifies the number of strands in each run of RF cable
INSTALLED METHOD	Identifies the method of installation in accordance with as designated herein
NOTES	Identifies a note number for a special feature or equipment
BUILDING MTC	Identifies the building by number or title

d. Analog Video Cabling Requirements/Column Explanation:

Column	Explanation
FROM BUILDING	Identifies building, by number or location, from which cabling is installed
TC ROOM NUMBER	Identifies the room, by number, from which cabling shall be installed
TO BUILDING IMC	Identifies building, by number or location, to which cabling is installed
TC ROOM NUMBER	Identifies the room, by number, to which cabling shall be installed
NUMBER OF STRANDS	Identifies the number of strands in each run of fiber optic cable

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INSTALLED METHOD	Identifies the method of installation in accordance with as designated herein
NOTES	Identifies a note number for a special feature or equipment
BUILDING MTC	Identifies the building by number or title

3. Telecommunication Outlets: The Contractor shall clearly and fully indicate this category for each outlet location and compare the total count to the locations identified above as a part of the technical submittal. Additionally, the Contractor shall indicate the total number of spares.

**PART 2 - PRODUCTS**

**2.1 EQUIPMENT AND MATERIALS**

A. System Requirements:

1. The System shall provide the following minimum services that are designed in accordance with and supported by an Original Equipment Manufacturer (OEM), and as specified herein. The System shall provide continuous inter and/or intra-Facility voice and data, and analog RF service. The System shall be capacity sized so that loss of connectivity to external telephone systems shall not affect the Facilities operation in specific designated locations. The System shall:
  - a. Be capable of inter-connecting and functioning fully with the existing Local Telephone Exchange (LEC) Network(s), Federal Telephone System (FTS) Inter-city Network(s), Inter-exchange Carriers, Integrated Services Digital Network (ISDN), Electronic Private Branch Exchange (EPBX) switches, asynchronous/synchronous data terminals and circuits including Automatic Transfer Mode (ATM), Frame Relay, and local area networks (LAN), at a minimum.
  - b. Be a voice and data cable distribution system that is based on a physical "Star" Topology. An Analog RF coaxial cable distribution system shall be provided in a "home run" configuration from each associated riser TC to identified locations and as shown on the drawings.
2. Specific Subsystem Requirements: The System shall consist, as a minimum, of the following independent sub-systems to comprise a complete and functional voice and digital and analog RF telecommunications cabling system: "Main" (MTC), "intermediate"

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(IMTC), and "riser" (RTC) TC's; "vertical" (or "riser") trunk cabling system; vertical cross-connection (VCC) cabling systems, and TCO's with a minimum of three Five (5) jacks for the appropriate telephone, Data connections, and additional jacks, connectors, drop and patch cords, terminators, and adapters provided.

a. Telecommunication Closet (TC):

- 1) There shall be a minimum of one TC for the MTC, each building IMTC, and each RTC per building floor location. However, in large building(s), where the horizontal distance to the farthest voice and digital work area may exceed 90 Meters (M) (or 295 feet [ft]), additional TC's shall be provided as described herein. The maximum DC resistance per cable pair shall be no more than 28.6 Ohms per 305 M (1,000 feet). Each TC shall be centrally located to cover the maximum amount of local floor space. The TC's house in cabinets or enclosures, on relay racks, and/or on backboards, various telecommunication data equipment, controllers, multiplexers, bridges, routers, LAN hub(s), telephone cross-connecting, active and passive equipment.
- 2) Additionally, the TC's may house fire alarm, nurses call, code one (or blue), video, public address, intercom. Regardless of the method of installation, mounting, termination, or cross-connecting used, all vertical copper and fiber optic and analog RF coaxial cables shall be terminated on appropriate cross-connection systems (CCS) containing patch panel(s), punch blocks, and/or breakout devices provided in enclosures and tested as described herein. A cable and/or wire management system shall be a part of each CCS.
  - a) A minimum of three 110-120 VAC active quad outlets shall be provided, each with "U" grounded receptacles at a minimum of one outlet for each front, side and back wall. These outlets shall be separately protected by an AC circuit breaker provided in the designated Government Emergency Critical Care AC power panel, that is connected to the Facilities Emergency AC Power Distribution System. For larger building TC applications, a minimum of one additional quad AC outlet shall be provided for every 800M<sup>2</sup>

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(or 8,000 ft<sup>2</sup>) of useable floor space. Additional outlets shall be equally spaced along the wall.

- b) Climate control shall be provided in each TC 24 hours a day, seven days per week and 52 week per year to prevent failure of electronic components and for mission critical functional applications. The Facility Chief Engineering Officer are responsible for informing the Contractor regarding the minimum climate control requirements. In identified hostile TC locations where it has been determined (by Facility Chief Engineer) that proper TC climate or external signal radiation cannot be properly maintained or controlled, the Contractor may, at his/her option, provide a minimum of two individual and properly sized self contained climate controlled equipment cabinet enclosures; one designated for voice, and one designated for data, in each TC location identified on the drawings, in lieu of providing additional required TC air handling capability.

**B. System Performance:**

- 1. At a minimum, the System shall be able to support the following voice and data and analog RF operations for Category 6 Certified Telecommunication Service:

- a. Telecommunications Outlet (TCO):

- 1) Voice:

- a) Isolation (outlet-outlet): 24 dB.
    - b) Impedance: 600 Ohms, balanced (BAL).
    - c) Signal Level: 0 deciBel per mili-Volt (dBmV)  $\pm$  0.1 dBmV.
    - d) System speed: 100 mBps, minimum.
    - e) System data error: 10 to the -6 Bps, minimum.

- 2) Data:

- a) Isolation (outlet-outlet): 24 dB.
    - b) Impedance: 600 Ohms, BAL.
    - c) Signal Level: 0 dBmV  $\pm$  0.1 dBmV.
    - d) System speed: 120 mBps, minimum.
    - e) System data error: 10 to the -8 Bps, minimum.

- 3) Fiber optic:

- a) Isolation (outlet-outlet): 36 dB.

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- b) Signal Level: 0 dBmV  $\pm$  0.1 dBmV.
- c) System speed: 540 mBps, minimum.
- d) System data error: 10 to the -6 BPS, minimum.
- 4) Analog RF Service: Broadcast or "off air" RF (or television) analog service is considered to be at RF (below 900 MHz in frequency bandwidth). Usually a RF television circuits require a single coaxial cable plant from the headend to each TC location.
  - a) Isolation (outlet-outlet): 14 dB.
  - b) Impedance: 75 Ohms, Unbalanced (UNBAL).
  - c) Signal Level: 10 dBmV  $\pm$  5.0 dBmV.
  - d) Bandwidth: 6.0 MHz per channel, fully loaded
- 5) Closed Circuit Analog Video Service: Analog video service is considered to be at baseband (below 100 MHz in frequency bandwidth). An analog video circuit requires a separate analog video from the audio connector. The following minimum operating parameters shall be capable over each installed analog video circuit:
  - a) Impedance: 75 Ohm, unbalanced.
  - b) Output Level: 1.0 V peak to peak (P-P), for 87.5% depth of Modulation (Mod).
  - c) Diff Gain:  $\pm$ 1 dB at 87.5% Mod.
  - d) Diff Phase:  $\pm$ 1.5 at 87.5% Mod.
  - e) Signal to Noise (S/N) ratio: 44 dB, minimum.
  - f) Hum Modulation: -55 dB.
  - g) Return Loss: -14 dB (or 1.5 Voltage Standing Wave Ratio [VSWR]), maximum.
  - h) Isolation (outlet-outlet): 24 dB, minimum.
  - i) Bandwidth: 6.0 MHz per channel, fully loaded, minimum.

**C. General:**

1. All equipment to be supplied under this specification shall be new and the current model of a standard product of an OEM or record. An OEM of record shall be defined as a company whose main occupation is the manufacture for sale of the items of equipment supplied and which:
  - a. Maintains a stock of replacement parts for the item submitted.

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- b. Maintains engineering drawings, specifications, and operating manuals for the items submitted.
  - c. Has published and distributed descriptive literature and equipment specifications on the items of equipment submitted at least 30 days prior to the Invitation for Bid.
2. Specifications of equipment as set forth in this document are minimum requirements, unless otherwise stated, and shall not be construed as limiting the overall quality, quantity, or performance characteristics of items furnished in the System. When the Contractor furnishes an item of equipment for which there is a specification contained herein, the item of equipment shall meet or exceed the specification for that item of equipment.
  3. The Contractor shall provide written verification, in writing to the RE at time of installation, that the type of wire/cable being provided is recommended and approved by the OEM. The Contractor is responsible for providing the proper size and type of cable duct and/or conduit and wiring even though the actual installation may be by another subcontractor.
  4. The Telephone Contractor is responsible for providing interfacing cable connections for the telephone, PA systems with the System.
  5. The telephone equipment and PA interface equipment shall be the interface points for connection of the PA interface cabling from the telephone switch via the system telephone interface unit.
  6. Active electronic component equipment shall consist of solid state components, be rated for continuous duty service, comply with the requirements of FCC standards for telephone equipment, systems, and service.
  7. All passive distribution equipment shall meet or exceed -80 dB radiation shielding specifications.
  8. All interconnecting twisted pair, fiber-optic or coaxial cables shall be terminated on equipment terminal boards, punch blocks, breakout boxes, splice blocks, and unused equipment ports/taps shall be terminated according to the OEM's instructions for telephone cable systems without adapters. The Contractor shall not leave unused or spare twisted pair wire, fiber-optic, or coaxial cable unterminated, unconnected, loose or unsecured.

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9. Color code all distribution wiring to conform to the Telephone Industry standard, EIA/TIA, and this document, which ever is the more stringent. At a minimum, all equipment, cable duct and/or conduit, enclosures, wiring, terminals, and cables shall be clearly and permanently labeled according to and using the provided record drawings, to facilitate installation and maintenance. Reference Specification Section 27 10 00, STRUCTURED CABLING and Section 27 31 00, VOICE COMMUNICATIONS SWITCHING AND ROUTING EQUIPMENT.
  10. Connect the System's primary input AC power to the Facility's Critical Branch of the Emergency AC power distribution system as shown on the plans or if not shown on the plans consult with RE regarding a suitable circuit location prior to bidding.
  11. Plug-in connectors shall be provided to connect all equipment, except coaxial cables and interface points. Coaxial cable distribution points and RF transmission lines shall use coaxial cable connections recommended by the cable OEM and approved by the System OEM. Base- band cable systems shall utilize barrier terminal screw type connectors, at a minimum. Crimp type connectors installed with a ratchet type installation tool are and acceptable alternate as long as the cable dress, pairs, shielding, grounding, and connections and labeling are provided the same as the barrier terminal strip connectors. Tape of any type, wire nuts, or solder type connections are unacceptable and will not be approved.
  12. All equipment faceplates utilized in the System shall be stainless steel, anodized aluminum, or UL approved cycolac plastic for the areas where provided.
  13. Noise filters and surge protectors shall be provided for each equipment interface cabinet, switch equipment cabinet, control console, local, and remote active equipment locations to ensure protection from input primary AC power surges and noise glitches are not induced into low Voltage data circuits.
- D. Equipment Functional Characteristics:

FUNCTIONS	CHARACTERISTICS
Input Voltage	105 to 130 VAC
POWER LINE FREQUENCY	60 HZ ±2.0 HZ
Operating Temperature	0 to 50 degrees (°) Centigrade (C)
Humidity	80 percent (%) minimum rating



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**E. Equipment Standards and Testing:**

1. The System has been defined herein as connected to systems identified as Critical Care performing Life Support Functions. Therefore, at a minimum, the system shall conform to all aforementioned National and/or Local Life Safety Codes (which ever are the more stringent), NFPA, NEC, this specification, JCAHCO Life Safety Accreditation requirements, and the OEM recommendations, instructions, and guidelines.
2. All supplies and materials shall be listed, labeled or certified by UL or a nationally recognized testing laboratory where such standards have been established for the supplies, materials or equipment. See paragraph minimum requirements Section 27 05 11, REQUIREMENTS FOR COMMUNICATIONS INSTALLATIONS, and the guidelines listed in paragraph 2.J.2.
3. The provided active and passive equipment required by the System design and approved technical submittal must conform with each UL standard in effect for the equipment, as of the date of the technical submittal (or the date when the RE approved system equipment necessary to be replaced) was technically reviewed and approved by VA. Where a UL standard is in existence for equipment to be used in completion of this contract, the equipment must bear the approved UL seal.
4. Each item of electronic equipment to be provided under this contract must bear the approved UL seal or the seal of the testing laboratory that warrants the equipment has been tested in accordance with, and conforms to the specified standards.

**F. Stand Alone Equipment (or sometimes called Radio Relay) Rack:**

1. The rack shall be constructed of heavy 16 gauge cold rolled steel and have fully adjustable equipment front mounting rails that allows front panel equipment mounting and access. It shall have baked-on iron phosphate primer and baked enamel paint finish in a color to be selected by the using Facility Service Chief or the RE. It shall be floor or wall mounted or mounted on casters as directed by the RE.
2. Technical Characteristics:

Overall Height	2180 mm (85 7/8in.), maximum
Overall Depth	650 mm (25 1/2in.), maximum

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Overall Width	535 mm (21 1/16in.), maximum
Front Panel Opening	480 mm (19in.), EIA horizontal width
Hole Spacing	per EIA and Industry Standards

G. Cross-Connection System (CCS) Equipment Breakout, Termination Connector (or Bulkhead), and Patch Panels:

1. The connector panel(s) shall be made of flat smooth 3.175 mm (1/8 in.) thick solid aluminum, custom designed, fitted and installed in the cabinet. Bulkhead equipment connectors shall be mounted on the panel to enable all cabinet equipment's signal, control, and coaxial cables to be connected through the panel. Each panel shall be color matched to the cabinet installed.

a. Voice (or Telephone):

- 1) The CSS for voice or telephone service shall be Industry Standard type BIX (minimum) punch blocks for voice or telephone, and control wiring in lieu of patch panels, each being certified for category six service. As a minimum, punch block strips shall be secured to an OEM designed physical anchoring unit on a wall location in the TC. However, console, cabinet, rail, panel, etc. mounting is allowed at the OEM recommendation and as approved by the RE. Punch blocks shall not be used for Class II or 120 VAC power wiring.

2) Technical Characteristics:

Number of horizontal rows	100, MINIMUM
Number of terminals per row	4, minimum
Terminal protector	required for each used or unused terminal
Insulation splicing	required between each row of terminals

b. Digital or High Speed Data:

- 1) The CSS for digital or high-speed data service shall be a patch panel with modular female RJ45 jacks installed in rows. Patch panels and RJ45 jacks shall be specifically designed for category six telecommunications service and the size and type of UTP or STP cable used. Each panel shall be 480 mm (19in.) horizontal EIA rack mountable dimensions with EIA standard spaced vertical mounting holes.

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2) Technical Characteristics:

Number of horizontal rows	2, minimum
Number of jacks per row	24, MINIMUM
Type of jacks	RJ45
Terminal protector	required for each used or unused jack
Insulation	required between each row of jacks

c. Fiber optic:

- 1) Product reference of a Government Approved (US State Department) type is Telewire, PUP-17 with pre-punched chassis mounting holes arranged in two horizontal rows. This panel may be used for fiber optic, audio, control cable, and Class II Low Voltage Wiring installations when provided with the proper connectors. This panel is not allowed to be used for 120 VAC power connections.

2) Technical Characteristics:

Height	Two rack units (RUs), 88 mm (3.5in.) minimum
Width	484 mm (19 1/16in.), EIA minimum
Number of connections	12 pairs, minimum
Connectors	
Audio Service	Use RCA 6.35 mm (1/4in.) Phono, XL or Barrier Strips, surface mounted with spade lugs (punch block or wire wrap type strips are acceptable alternates for barrier strips as long as system design is maintained and RE approved)
Control Signal Service	Barrier strips surface mounted with spade lugs (punch block or wire wrap type strips are acceptable alternates for barrier strips as long as system design is maintained and RE approved)
Low voltage power (class II)	Barrier strips with spade lugs and clear full length plastic cover, surfaced mounted
Fiber optic	"ST" Stainless steel, female

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d. Mounting Strips and Blocks:

- 1) Barrier Strips: Barrier strips are approved for AC power, data, voice, and control cable or wires. Barrier strips shall accommodate the size and type of audio spade (or fork type) lugs used with insulating and separating strips between the terminals for securing separate wires in a neat and orderly fashion. Each cable or wire end shall be provided with an audio spade lug, which is connected to an individual screw terminal on the barrier strip. The barrier strips shall be surface secured to a console, cabinet, rail, panel, etc. 120 VAC power wires shall not be connected to signal barrier strips.

2) Technical Characteristics:

Terminal size	6-32, minimum
Terminal Count	ANY COMBINATION
Wire size	20 AWG, minimum
Voltage handling	100 V, minimum
Protective connector cover	Required for Class II and 120 VAC power connections

2. Solderless Connectors: The connectors (or fork connectors) shall be crimp-on insulated lug to fit a 6-32 minimum screw terminal. The fork connector shall be installed using a standard lug-crimping tool.
3. Punch Blocks: As a minimum, Industry Standard BIX type punch blocks are approved for voice, and control wiring. Punch blocks shall be specifically designed for the size and type of wire used. Punch block strips shall be secured to a console, cabinet, rail, panel, etc. Punch blocks shall not be used for Class II or 120 VAC power wiring.

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**H. Wire Management System and Equipment:**

1. Wire Management System: The system(s) shall be provided as the management center of the respective cable system, CCS, and TC it is incorporated. It shall perform as a platform to house peripheral equipment in a standard relay rack or equipment cabinet. It shall be arranged in a manner as to provide convenient access to all installed management and other equipment. All cables and connections shall be at the rear of each system interface to IDC and/or patch panels, punch blocks, wire wrap strips, and/or barrier strip.
2. Wire Management Equipment: The wire management equipment shall be the focal point of each wire management system. It shall provide an orderly interface between outside and inside wires and cables (where used), distribution and interface wires and cables, interconnection wires and cables and associated equipment, jumper cables, and provide a uniform connection media for all system fire retardant wires and cables and other subsystems. It shall be fully compatible and interface to each cable tray, duct, wireway, or conduit used in the system. All interconnection or distribution wires and cables shall enter the system at the top (or from a wireway in the floor) via a overhead protection system and be uniformly routed down either side (or both at the same time) of the frames side protection system then laterally via a anchoring or routing shelf for termination on the rear of each respective terminating assembly. Each system shall be custom configured to meet the System design and user needs.

**2.3 ENVIRONMENTAL REQUIREMENTS**

Technical submittals shall identify the environmental specifications for housing the system. These environmental specifications shall identify the requirements for initial and expanded system configurations for:

- A. Floor loading for batteries and cabinets.
- B. Minimum floor space and ceiling heights.
- C. Minimum size of doors for equipment passage.
- D. Power requirements: The bidders shall provide the specific voltage, amperage, phases, and quantities of circuits required.
- E. Air conditioning, heating, and humidity requirements. The bidder shall identify the ambient temperature and relative humidity operating ranges required preventing equipment damage.

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- F. Air conditioning requirements (expressed in BTU per hour, based on adequate dissipation of generated heat to maintain required room and equipment standards).
- G. Proposed floor plan based on the expanded system configuration of the bidder's proposed EPBX for this Facility.
- H. Conduit size requirement (between equipment room and console room).

**2.4 INSTALLATION KIT**

The kit shall be provided that, at a minimum, includes all connectors and terminals, labeling systems, audio spade lugs, barrier strips, punch blocks or wire wrap terminals, heat shrink tubing, cable ties, solder, hangers, clamps, bolts, conduit, cable duct, and/or cable tray, etc., required to accomplish a neat and secure installation. All wires shall terminate in a spade lug and barrier strip, wire wrap terminal or punch block. Unfinished or unlabeled wire connections shall not be allowed. Turn over to the RE all unused and partially opened installation kit boxes, coaxial, fiberoptic, and twisted pair cable reels, conduit, cable tray, and/or cable duct bundles, wire rolls, physical installation hardware. The following are the minimum required installation sub-kits:

- A. System Grounding:
  - 1. The grounding kit shall include all cable and installation hardware required. All radio equipment shall be connected to earth ground via internal building wiring, according to the NEC.
  - 2. This includes, but is not limited to:
    - a. Coaxial Cable Shields.
    - b. Control Cable Shields.
    - c. Data Cable Shields.
    - d. Equipment Racks.
    - e. Equipment Cabinets.
    - f. Conduits.
    - g. Duct.
    - h. Cable Trays.
    - i. Power Panels.
    - j. Connector Panels.
    - k. Grounding Blocks.

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- B. Coaxial Cable: The coaxial cable kit shall include all coaxial connectors, cable tying straps, heat shrink tabbing, hangers, clamps, etc., required to accomplish a neat and secure installation.
- C. Wire and Cable: The wire and cable kit shall include all connectors and terminals, audio spade lugs, barrier straps, punch blocks, wire wrap strips, heat shrink tubing, tie wraps, solder, hangers, clamps, labels etc., required to accomplish a neat and orderly installation.
- D. Conduit, Cable Duct, and Cable Tray: The kit shall include all conduit, duct, trays, junction boxes, back boxes, cover plates, feed through nipples, hangers, clamps, other hardware required to accomplish a neat and secure conduit, cable duct, and/or cable tray installation in accordance with the NEC and this document.
- E. Equipment Interface: The equipment kit shall include any item or quantity of equipment, cable, mounting hardware and materials needed to interface the systems with the identified sub-system(s) according to the OEM requirements and this document.
- F. Labels: The labeling kit shall include any item or quantity of labels, tools, stencils, and materials needed to completely and correctly label each subsystem according to the OEM requirements, as-installed drawings, and this document.
- G. Documentation: The documentation kit shall include any item or quantity of items, computer discs, as installed drawings, equipment, maintenance, and operation manuals, and OEM materials needed to completely and correctly provide the system documentation as required by this document and explained herein.

**PART 3 - EXECUTION**

**3.1 INSTALLATION**

- A. Product Delivery, Storage and Handling:
  - 1. Delivery: Deliver materials to the job site in OEM's original unopened containers, clearly labeled with the OEM's name and equipment catalog numbers, model and serial identification numbers. The RE may inventory the cable, patch panels, and related equipment.
  - 2. Storage and Handling: Store and protect equipment in a manner, which will preclude damage as directed by the RE.
- B. System Installation:
  - 1. After the contract's been awarded, and within the time period specified in the contract, the Contractor shall deliver the total

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system in a manner that fully complies with the requirements of this specification. The Contractor shall make no substitutions or changes in the System without written approval from the RE and PM.

2. The Contractor shall install all equipment and systems in a manner that complies with accepted industry standards of good practice, OEM instructions, the requirements of this specification, and in a manner which does not constitute a safety hazard. The Contractor shall insure that all installation personnel understands and complies with all the requirements of this specification.
3. The Contractor shall install suitable filters, traps, directional couplers, splitters, TC's, and pads for minimizing interference and for balancing the System. Items used for balancing and minimizing interference shall be able to pass telephone and data, and , and analog signals in the frequency bands selected, in the direction specified, with low loss, and high isolation, and with minimal delay of specified frequencies and signals. The Contractor shall provide all equipment necessary to meet the requirements of Paragraph 2.1.C and the System performance standards.
4. All passive equipment shall be connected according to the OEM's specifications to insure future correct termination, isolation, impedance match, and signal level balance at each telephone/data outlet.
5. Where TCOs are installed adjacent to each other, install one outlet for each instrument.
6. All lines shall be terminated in a suitable manner to facilitate future expansion of the System. There shall be a minimum of one spare 25 pair cable at each distribution point on each floor.
7. All vertical copper and fiber optic, and coaxial cables shall be terminated so any future changes only requires modifications of the existing EPBX or signal closet equipment only.
8. Terminating resistors or devices shall be used to terminate all unused branches, outlets, equipment ports of the System, and shall be devices designed for the purpose of coaxial cables carrying analog signals in analog video systems.
9. Equipment installed outdoors shall be weatherproof or installed in weatherproof enclosures with hinged doors and locks with two keys.



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10. Equipment installed indoors shall be installed in metal cabinets with hinged doors and locks with two keys.

C. Conduit and Signal Ducts:

1. Conduit:

- a. The Contractor shall employ the latest installation practices and materials. The Contractor shall provide conduit, junction boxes, connectors, sleeves, weatherheads, pitch pockets, and associated sealing materials not specifically identified in this document as GFE. Conduit penetrations of walls, ceilings, floors, interstitial space, fire barriers, etc., shall be sleeved and sealed. The minimum conduit size shall be 19 mm (3/4 in.).
- b. All cables shall be installed in separate conduit and/or signal ducts (exception from the separate conduit requirement to allow telephone cables to be installed in partitioned cable tray with data cables may be granted in writing by the RE if requested.) Conduits shall be provided in accordance with Section 27 05 33, RACEWAYS AND BOXES FOR COMMUNICATIONS SYSTEMS, and NEC Articles 517 for Critical Care and 800 for Communications systems, at a minimum.
- c. When metal, plastic covered, etc., flexible cable protective armor or systems are specifically authorized to be provided for use in the System, their installation guidelines and standards shall be as specified herein, Section 27 05 33, RACEWAYS AND BOXES FOR COMMUNICATIONS SYSTEMS, and the NEC.
- d. When "innerduct" flexible cable protective systems is specifically authorized to be provided for use in the System, it's installation guidelines and standards shall be as the specified herein, Section 27 05 33, RACEWAYS AND BOXES FOR COMMUNICATIONS SYSTEMS, and the NEC.
- e. Conduit (including GFE) fill shall not exceed 40%. Each conduit end shall be equipped with a protective insulator or sleeve to cover the conduit end, connection nut or clamp, to protect the wire or cable during installation and remaining in the conduit. Electrical power conduit shall be installed in accordance with the NEC. AC power conduit shall be run separate from signal conduit.

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- f. When metal, plastic covered, etc., flexible cable protective armor or systems are specifically authorized to be provided for use in the System, their installation guidelines and standards shall be as specified herein, Section 27 05 33, RACEWAYS AND BOXES FOR COMMUNICATIONS SYSTEMS, and the NEC.
    - g. Ensure that Critical Care, Nurse Call, and PA Systems (as identified by NEC Section 517) are completely separated and protected from all other systems.
  - 2. Signal Duct, Cable Duct, or Cable Tray:
    - a. The Contractor shall use existing signal duct, cable duct, and/or cable tray, when identified and approved by the RE.
    - b. Approved signal and/or cable duct shall be a minimum size of 100 mm x 100 mm (4 in. X 4 in.) inside diameter with removable tops or sides, as appropriate. Protective sleeves, guides or barriers are required on all sharp corners, openings, anchors, bolts or screw ends, junction, interface and connection points.
    - c. Approved cable tray shall be UL certified and labeled for use with telecommunication circuits and/or systems. The RE shall approve width and height dimensions.
- D. Connectors: Circuits, transmission lines, and signal extensions shall have continuity, correct connection and polarity. A uniform polarity shall be maintained between all points in the system.
  - 1. Wires:
    - a. Wire ends shall be neatly formed and where insulation has been cut, heat shrink tubing shall be employed to secure the insulation on each wire. Tape of any type is not acceptable.
    - b. Audio spade lugs shall be installed on each wire (including spare or unused) end and connect to screw terminals of appropriate size barrier strips. AC barrier strips shall be provided with a protective cover to prevent accidental contact with wires carrying live AC current. Punch blocks are approved for signal, not AC wires. Wire Nut or "Scotch Lock" connectors are not acceptable for signal wire installation.
  - 2. Cables: Each connector shall be designed for the specific size cable being used and installed with the OEM's approved installation tool. Typical system cable connectors include; but, are not limited to: Audio spade lug, punch block, wirewrap, etc.

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3. Line Audio: Each connector shall be installed according to the cable or connector OEM's instructions and use the OEM's approved installation tool. Install the connector's to provide and maintain the following audio signal polarity:
  - a. Two and 3 conductor 1/4" Signal or positive conductor is tip; neutral or 1/8" phono plugs conductor is ring and ground or shield and jacks conductor is sleeve.
  - b. RCA Phono Plugs the Signal or positive conductor is tip; and Jacks neutral or shield conductor is sleeve.
4. Speaker Line Audio:
  - a. Each connector shall be installed according to the cable, transformer or speaker OEM instructions and using the OEM's approved installation tool. The Contractor shall ensure each speaker is properly phased and connected in the same manner throughout the System using two conductor type wires.
  - b. One of the conductors shall be color coded to aid in establishing speaker signal polarity. Each speaker line shall be permanently soldered or audio spade lug connected to each appropriate speaker or line matching transformer connection terminal. Speaker line connection to each audio amplifier shall use audio spade lugs, as described herein.
- E. AC Power: AC power wiring shall be run separately from signal cable.
- F. Grounding:
  1. General: The Contractor shall ground all Contractor Installed Equipment and identified Government Furnished Equipment to eliminate all shock hazards and to minimize, to the maximum extent possible, all ground loops, common mode returns, noise pickup, crosstalk, etc. The total ground resistance shall be 0.1 Ohm or less.
    - a. The Contractor shall install lightning arrestors and grounding in accordance with the NFPA and this specification.
    - b. Under no conditions shall the AC neutral, either in a power panel or in a receptacle outlet, be used for system control, subcarrier or audio reference ground.
  - C. The use of conduit, signal duct or cable trays as system or electrical ground is not acceptable and will not be permitted. These items may be used only for the dissipation of internally generated static charges (not to be confused with externally

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generated lightning) that may applied or generated outside the mechanical and/or physical confines of the System to earth ground. The discovery of improper system grounding shall be grounds to declare the System unacceptable and the termination of all system acceptance testing.

2. Cabinet Buss: A common ground buss of at least #10 AWG solid copper wire shall extend throughout each equipment cabinet and be connected to the system ground. Provide a separate isolated ground connection from each equipment cabinet ground buss to the system ground. Do not tie equipment ground busses together.
3. Equipment: Equipment shall be bonded to the cabinet bus with copper braid equivalent to at least #12 AWG. Self grounding equipment enclosures, racks or cabinets, that provide OEM certified functional ground connections through physical contact with installed equipment, are acceptable alternates.
4. Cable Shields: Cable shields shall be bonded to the cabinet ground buss with #12 AWG minimum stranded copper wire at only one end of the cable run. Cable shields shall be insulated from each other, faceplates, equipment racks, consoles, enclosures or cabinets; except, at the system common ground point. Coaxial and audio cables, shall have one ground connection at the source; in all cases, cable shield ground connections shall be kept to a minimum.

**G. Equipment Assembly:**

1. Cabinets:
  - a. Each enclosure shall be: floor or wall mounted with standard knockout holes for conduit connections or cable entrance; provide for ventilation of the equipment; have front and rear locking doors (except wall mounted cabinets that require only a front locking door); power outlet strip(s), and connector or patch panel(s).
  - b. Rack (including freestanding radio relay) mounted equipment shall be installed in the enclosure's equipment adjustable mounting racks with equipment normally requiring adjustment or observation mounted so operational adjustment(s) can be conveniently made. Heavy equipment shall be mounted with rack slides or rails allowing servicing from the front of the enclosure. Heavy equipment shall not depend only upon front panel mounting screws

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for support. Equipment shall be provided with sufficient cable slack to permit servicing by removal of the installed equipment from the front of the enclosure. A color matched blank panel (spacer) of 44 mm (1.75 in.) high, shall be installed between each piece of equipment (active or passive) to insure adequate air circulation. The enclosure shall be designed for efficient equipment cooling and air ventilation. Each console or cabinet shall be equipped with a quiet fan and nondisposable air filter.

- c. Enclosures and racks shall be installed plumb and square. Each shall be permanently attached to the building structure and held firmly in place. Fifteen inches of front vertical space opening shall be provided for additional equipment.
- d. Signal connector, patch, and bulkhead panels (i.e.: audio, data, control, analog video, etc.) shall be connected so that outputs from each source, device or system component shall enter the panel at the top row of jacks, beginning left to right as viewed from the front, which will be called "inputs". Each connection to a load, device or system component shall exit the panel at the bottom row of jacks, beginning left to right as viewed from the front, which will be called "outputs".
  - 1) Equipment located indoors shall be installed in metal racks or enclosures with hinged doors to allow access for maintenance without causing interference to other nearby equipment.
  - 2) Cables shall enter the equipment racks or enclosures in such a manner that allows all doors or access panels to open and close without disturbing or damaging the cables.
  - 3) All distribution hardware shall be securely mounted in a manner that allows access to the connections for testing and provides sufficient room for the doors or access panels to open and close without disturbing the cables.

H. Labeling: Provide labeling in accordance with ANSI/EIA/TIA-606-B. All lettering for voice and data circuits shall be stenciled using thermal ink transfer process. Handwritten labels are not acceptable.

- 1. Cable and Wires (Hereinafter referred to as "Cable"): Cables shall be labeled at both ends in accordance with ANSI/EIA/TIA-606-A. Labels shall be permanent in contrasting colors. Cables shall be identified according to the System "Record Wiring Diagrams".

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2. Equipment: System equipment shall be permanently labeled with contrasting plastic laminate or bakelite material. System equipment shall be labeled on the face of the unit corresponding to its source.
3. Conduit, Cable Duct, and/or Cable Tray: The Contractor shall label all conduit, duct and tray, including utilized GFE, with permanent marking devices or spray painted stenciling a minimum of 3 meters (10 ft.) identifying it as the System. In addition, each enclosure shall be labeled according to this standard.
4. Termination Hardware: The Contractor shall label workstation outlets and patch panel connections using color coded labels with identifiers in accordance with ANSI/EIA/TIA-606-A and the "Record Wiring Diagrams".

**3.2 TESTS**

**A. Interim Inspection:**

1. This inspection shall verify that the equipment provided adheres to the installation requirements of this document. The interim inspection will be conducted by a factory-certified representative and witnessed by a Government Representative. Each item of installed equipment shall be checked to insure appropriate UL certification markings. This inspection shall verify cabling terminations in telecommunications rooms and at workstations adhere to color code for T568A pin assignments and cabling connections are in compliance with ANSI/EIA/TIA standards. Visually confirm Category 6 marking of outlets, faceplates, outlet/connectors and patch cords.
2. Perform fiber optical field inspection tests via attenuation measurements on factory reels and provide results along with manufacturer certification for factory reel tests. Remove failed cable reels from project site upon attenuation test failure.
3. The Contractor shall notify the RE, in writing, of the estimated date the Contractor expects to be ready for the interim inspection, at least 20 working days before the requested inspection date.
4. Results of the interim inspection shall be provided to the RE and PM. If major or multiple deficiencies are discovered, a second interim inspection may be required before permitting the Contractor to continue with the system installation.

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5. The RE and/or the PM shall determine if an additional inspection is required, or if the Contractor will be allowed to proceed with the installation. In either case, re-inspection of the deficiencies noted during the interim inspection(s), will be part of the proof of performance test. The interim inspection shall not affect the Systems' completion date. The Contracting Officer shall ensure all test documents will become a part of the Systems record documentation.

**B. Pretesting:**

1. Upon completing the installation of the System, the Contractor shall align and balance the system. The Contractor shall pretest the entire system.
2. Pretesting Procedure:
  - a. During the system pretest, the Contractor shall verify (utilizing the approved spectrum analyzer and test equipment) that the System is fully operational and meets all the system performance requirements of this standard.
  - b. The Contractor shall pretest and verify that all System functions and specification requirements are met and operational, no unwanted aural effects, such as signal distortion, noise pulses, glitches, audio hum, poling noise, etc. are present. The Contractor shall measure and record the aural carrier levels of each system telephone and data channel, at each of the following points in the system:
    - 1) Signal Level at each interface point to the distribution system, the last outlet on each trunk line plus all outlets installed as part of this contract.
3. The Contractor shall provide four (4) copies of the recorded system pretest measurements and the written certification that the System is ready for the formal acceptance test shall be submitted to the RE.

**C. Acceptance Test:**

1. After the System has been pretested and the Contractor has submitted the pretest results and certification to the RE, then the Contractor shall schedule an acceptance test date and give the RE 30 days written notice prior to the date the acceptance test is expected to begin. The System shall be tested in the presence of a Government

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Representative and an OEM certified representative. The System shall be tested utilizing the approved test equipment to certify proof of performance and Life Safety compliance. The test shall verify that the total System meets the requirements of this specification. The notification of the acceptance test shall include the expected length (in time) of the test.

**D. Verification Tests:**

1. Test the UTP copper cabling for DC loop resistance, shorts, opens, intermittent faults, and polarity between conductors, and between conductors and shield, if cable has an overall shield. Test the operation of shorting bars in connection blocks. Test cables after termination and prior to cross-connection.
2. Multimode Fiber Optic Cable: Perform end-to-end attenuation tests in accordance with ANSI/EIA/TIA-568-B.3 and ANSI/EIA/TIA-526-14A using Method A, Optical Power Meter and Light Source. Perform verification acceptance test.
3. Single Mode Fiber Optic Cable: Perform end-to-end attenuation tests in accordance with ANSI/EIA/TIA-568-B.3 and ANSI/EIA/TIA-526-7 using Method A, Optical Power Meter and Light Source. Perform verification acceptance test.

**E. Performance Testing:**

1. Perform Category 6 tests in accordance with ANSI/EIA/TIA-568-B.1 and ANSI/EIA/TIA-568-B.2. Test shall include the following: wire map, length, insertion loss, return loss, NEXT, PSNEXT, ELFEXT, PSELFEXT, propagation delay and delay skew.
2. Fiber Optic Links: Perform end-to-end fiber optic cable link tests in accordance with ANSI/EIA/TIA-568-B.3.

**F. Total System Acceptance Test:** The Contractor shall perform verification tests for UTP copper cabling system(s) and the multimode and single mode fiber optic cabling system(s) after the complete telecommunication distribution system and workstation outlet are installed.

1. Data Testing: Connect to the network interface device at the demarcation point. Log onto the network to ensure proper connection to the network is achieved.

**3.3 TRAINING**

- A. Furnish the services of a factory-trained engineer or technician for a total of two four hour classes to instruct designated Facility IRM



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personnel. Instruction shall include cross connection, corrective, and preventive maintenance of the System and equipment.

- B. Before the System can be accepted by the VA, this training must be accomplished. Training will be scheduled at the convenience of the Facilities Contracting Officer and Chief of Engineering Service.

**3.4 WARRANTY**

- A. Comply with FAR clause 52.246-21, except that warranty shall be as follows:

1. The Contractor shall warranty that all installed material and equipment will be free from defects, workmanship, and will remain so for a period of one year from date of final acceptance of the System by the VA. The Contractor shall provide OEM's equipment warranty documents, to the RE (or Facility Contracting Officer if the Facility has taken possession of the building(s)), that certifies each item of equipment installed conforms to OEM published specifications.
2. The Contractor's maintenance personnel shall have the ability to contact the Contractor and OEM for emergency maintenance and logistic assistance, remote diagnostic testing, and assistance in resolving technical problems at any time. The Contractor and OEM shall provide this contact capability at no additional cost to the VA.
3. All Contractor installation, maintenance, and supervisor personnel shall be fully qualified by the OEM and must provide two (2) copies of current and qualified OEM training certificates and OEM certification upon request.
4. Additionally, the Contractor shall accomplish the following minimum requirements during the one year warranty period:
  - a. Response Time:
    - 1) The RE (or facility Contracting Officer if the facility has taken possession of the building[s]) are the Contractor's reporting and contact officials for the System trouble calls, during the guarantee period.
    - 2) A standard workweek is considered 8:00 A.M. to 5:00 P.M., Monday through Friday exclusive of Federal Holidays.

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- 3) The Contractor shall respond and correct on-site trouble calls, during the standard work week to:
    - a) A routine trouble call within one working days of its report. A routine trouble is considered a trouble which causes a system outlet, station, or patch cord to be inoperable.
    - b) An emergency trouble call within 6 hours of its report. An emergency trouble is considered a trouble which causes a subsystem or distribution point to be inoperable at anytime. Additionally, the loss of a minimum of 50 station or system lines shall be deemed as this type of a trouble call.
  - 4) The Contractor shall respond on-site to a catastrophic trouble call within 4 hours of its report. A catastrophic trouble call is considered total system failure.
    - a) If a system failure cannot be corrected within four hours (exclusive of the standard work time limits), the Contractor shall be responsible for providing alternate system CSS or TCO equipment, or cables. The alternate equipment and/or cables shall be operational within four hours after the four hour trouble shooting time.
    - b) Routine or emergency trouble calls in critical emergency health care facilities (i.e., cardiac arrest, intensive care units, etc.) shall also be deemed as a catastrophic trouble call if so determined by the RE or Facility Director. The RE or Facility Contracting Officer shall notify the Contractor of this type of trouble call at the direction of the Facilities Director.
- b. Required on-site visits during the one year warranty period
- 1) The Contractor shall visit, on-site, for a minimum of eight hours, once every 12 weeks, during the guarantee period, to perform system preventive maintenance, equipment cleaning, and operational adjustments to maintain the System according the descriptions identified in this SPEC.
    - a) The Contractor shall arrange all Facility visits with the RE or Facility Contracting Officer prior to performing the required maintenance visits.

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- b) The Contractor in accordance with the OEM's recommended practice and service intervals shall perform preventive maintenance during a non-busy time agreed to by the RE or Facility Contracting Officer and the Contractor.
  - c) The preventive maintenance schedule, functions and reports shall be provided to and approved by the RE or Facility Contracting Officer.
- 2) The Contractor shall provide the RE or Facility Contracting Officer a type written report itemizing each deficiency found and the corrective action performed during each required visit or official reported trouble call. The Contractor shall provide the RE with sample copies of these reports for review and approval at the beginning of the Total System Acceptance Test. The following reports are the minimum required:
- a) Monthly Report: The Contractor shall provide a monthly summary all equipment and sub-systems serviced during this guarantee period to RE or Facilities Contracting Officer by the fifth working day after the end of each month. The report shall clearly and concisely describe the services rendered, parts replaced and repairs performed. The report shall prescribe anticipated future needs of the equipment and Systems for preventive and predictive maintenance
  - b) Contractor Log: The Contractor shall maintain a separate log entry for each item of equipment and each sub-system of the System. The log shall list dates and times of all scheduled, routine, and emergency calls. Each emergency call shall be described with details of the nature and causes of emergency steps taken to rectify the situation and specific recommendations to avoid such conditions in the future.
- 3) The RE or Facility Contracting Officer shall provide the Facility Engineering Officer, two (2) copies of actual reports for evaluation.
- a) The RE or Facility Contracting Officer shall ensure copies of these reports are entered into the System's official acquisition documents.

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b) The Facilities Chief Engineer shall ensure copies of these reports are entered into the System's official technical as-installed documents.

B. Work Not Included: Maintenance and repair service shall not include the performance of any work due to improper use, accidents, other vendor, contractor, owner tampering or negligence, for which the Contractor is not directly responsible and does not control. The Contractor shall immediately notify the RE or Facility Contracting Officer in writing upon the discovery of these incidents. The RE or Facility Contracting Officer will investigate all reported incidents and render findings concerning any Contractor's responsibility.

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SECTION 27 15 00  
COMMUNICATIONS HORIZONTAL CABLING

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This Section specifies the furnishing, installing, certification, testing, and guaranty of a complete and operating Voice and Digital Cable Distribution System (here-in-after referred to as "*the System*"), and associated equipment and hardware to be installed in the VA Medical Center here-in-after referred to as "*the Facility*". The System shall include, but not be limited to: equipment cabinets, interface enclosures, and relay racks; necessary combiners, traps, and filters; and necessary passive devices such as: splitters, couplers, cable "patch", "punch down", and cross-connector blocks or devices, voice and data distribution sub-systems, and associated hardware. The System shall additionally include, but not be limited to: telecommunication closets (TC); telecommunications outlets (TCO); copper and fiber optic, and analog radio frequency (RF) systems coaxial distribution cables, connectors, "patch" cables, and/or "break out" devices.
- B. The System shall be delivered free of engineering, manufacturing, installation, and functional defects. It shall be designed, engineered, and installed for ease of operation, maintenance, and testing.
- C. The term "provide", as used herein, shall be defined as: designed, engineered, furnished, installed, certified, and tested, by the Contractor.
- D. The Voice and Digital and Analog Telecommunication Distribution Cable Equipment and System provides the media which voice and data information travels over and connects to the Telephone System which is defined as an Emergency Critical Care Communication System by the National Fire Protection Association (NFPA). Therefore, since the System connects to or extends the telephone system, the System's installation and operation shall adhere to all appropriate National, Government, and/or Local Life Safety and/or Support Codes, which ever are the more stringent for this Facility. At a minimum , the System shall be installed according to NFPA, Section 70, National Electrical Code (NEC), Article 517 and Chapter 7; NFPA, Section 99, Health Care Facilities, Chapter 3-4; NFPA, Section 101, Life Safety Code, Chapters 7, 12, and/or 13; Joint Commission on Accreditation of Health

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Care Organization (JCAHCO), Manual for Health Care Facilities, all necessary Life Safety and/or Support guidelines; this specification; and the original equipment manufacturer's (OEM) suggested installation design, recommendations, and instructions. The OEM and Contractor shall ensure that all management, sales, engineering, and installation personnel have read and understand the requirements of this specification before the System is designed, engineered, delivered, and provided.

- E. The VA Project Manager (PM) and/or if delegated, Resident Engineer (RE) are the approving authorities for all contractual and mechanical changes to the System. The Contractor is cautioned to obtain in writing, all approvals for system changes relating to the published contract specifications and drawings, from the PM and/or the RE before proceeding with the change.

F. System Performance:

1. At a minimum, the System shall be able to support the following voice and data and analog RF operations for Category 6 Certified Telecommunication Service:

a. Telecommunications Outlet (TCO):

1) Voice:

- a) Isolation (outlet-outlet): 24 dB.
- b) Impedance: 600 Ohms, balanced (BAL).
- c) Signal Level: 0 deciBel per mili-Volt (dBmV)  $\pm$  0.1 dBmV.
- d) System speed: 100 mBps, minimum.
- e) System data error: 10 to the -6 Bps, minimum.

2) Data:

- a) Isolation (outlet-outlet): 24 dB.
- b) Impedance: 600 Ohms, BAL.
- c) Signal Level: 0 dBmV  $\pm$  0.1 dBmV.
- d) System speed: 120 mBps, minimum.
- e) System data error: 10 to the -8 Bps, minimum.

3) Fiber optic:

- a) Isolation (outlet-outlet): 36 dB.
- b) Signal Level: 0 dBmV  $\pm$  0.1 dBmV.
- c) System speed: 540 mBps, minimum.
- d) System data error: 10 to the -6 bps, minimum.

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4) Analog RF Service:

- a) Broadcast or "off air" RF (or television) analog service is considered to be at RF (below 900 mHz in frequency bandwidth). Usually a RF television circuits require a single coaxial cable plant from the headend to each TC location.
- b) Isolation (outlet-outlet): 14 dB.
- c) Impedance: 75 Ohms, Unbalanced (UNBAL).
- d) Signal Level: 10 dBmV  $\pm$  5.0 dBmV.
- e) Bandwidth: 6.0 mHz per channel, fully loaded.

**1.2 RELATED WORK**

- A. Specification Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Specification Section 27 05 11, REQUIREMENTS FOR COMMUNICATIONS INSTALLATIONS.
- C. Specification Section 27 05 33, RACEWAYS AND BOXES FOR COMMUNICATIONS SYSTEMS.
- D. Specification Section 27 10 00, STRUCTURED CABLING.
- E. Specification Section 26 27 26, WIRING DEVICES.
- F. Specification Section 27 05 26, GROUNDING AND BONDING FOR COMMUNICATIONS SYSTEMS.
- G. Specification Section 26 41 00, FACILITY LIGHTNING PROTECTION.
- H. Specification Section 27 51 16, PUBLIC ADDRESS AND MASS NOTIFICATION SYSTEMS.
- I. Specification Section 27 41 31, MASTER ANTENNA TV EQUIPMENT AND SYSTEMS.
- J. H-088-C3 VA HANDBOOK DESIGN FOR TELEPHONE SYSTEMS

**1.3 APPLICABLE PUBLICATIONS**

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in text by basic designation only. Except for a specific date given the issue in effect (including amendments, addenda, revisions, supplements, and errata) on the date the system's submittal is technically approved by VA, shall be enforced.
- B. National Fire Protection Association (NFPA):

70	NATIONAL ELECTRICAL CODE (NEC)
75	Protection of Electronic Computer/Data Processing

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	Equipment
77	Recommended Practice on Static Electricity
	Standard for Health Care Facilities
101	Life Safety Code
1221	Emergency Services Communication Systems

C. Underwriters Laboratories, Inc. (UL):

65	Wired Cabinets
96	Lightning Protection Components
96A	INSTALLATION REQUIREMENTS FOR LIGHTNING PROTECTION SYSTEMS
467	Grounding and Bonding Equipment
497/497A/497B	PROTECTORS FOR PAIRED CONDUCTORS/ COMMUNICATIONS CIRCUITS/DATA COMMUNICATIONS AND FIRE ALARM CIRCUITS
884	Underfloor Raceways and Fittings

D. ANSI/EIA/TIA Publications:

568C.1	Commercial Building Telecommunications Wiring Standard
569C	Commercial Building Standard for Telecommunications Pathways and Spaces
606B	ADMINISTRATION STANDARD FOR THE TELECOMMUNICATIONS INFRASTRUCTURE OF COMMERCIAL BUILDINGS
607B	Grounding and Bonding Requirements for Telecommunications in Commercial Buildings

E. Lucent Technologies: Document 900-200-318 "Outside Plant Engineering Handbook".

F. International Telecommunication Union - Telecommunication Standardization Sector (ITU-T).

G. Federal Information Processing Standards (FIPS) Publications.

H. Federal Communications Commission (FCC) Publications: Standards for telephone equipment and systems.

I. United States Air Force: Technical Order 33K-1-100 Test Measurement and Diagnostic Equipment (TMDE) Interval Reference Guide.

J. Joint Commission on Accreditation of Health Care Organization (JCAHO): Comprehensive Accreditation Manual for Hospitals.



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K. National and/or Government Life Safety Code(s): The more stringent of each listed code.

**1.4 QUALITY ASSURANCE**

- A. The authorized representative of the OEM, shall be responsible for the design, satisfactory total operation of the System, and its certification.
- B. The OEM shall meet the minimum requirements identified in Paragraph 2.1.A. Additionally, the Contractor shall have had experience with three or more installations of systems of comparable size and complexity with regards to coordinating, engineering, testing, certifying, supervising, training, and documentation. Identification of these installations shall be provided as a part of the submittal as identified in Paragraph 1.5.
- C. The System Contractor shall submit certified documentation that they have been an authorized distributor and service organization for the OEM for a minimum of three (3) years. The System Contractor shall be authorized by the OEM to certify and warranty the installed equipment. In addition, the OEM and System Contractor shall accept complete responsibility for the design, installation, certification, operation, and physical support for the System. This documentation, along with the System Contractor and OEM certification must be provided in writing as part of the Contractor's Technical Submittal.
- D. All equipment, cabling, terminating hardware, TCOs, and patch cords shall be sourced from the certifying OEM or at the OEM's direction, and support the System design, the OEM's quality control and validity of the OEM's warranty.
- E. The Contractor's Telecommunications Technicians assigned to the System shall be fully trained, qualified, and certified by the OEM on the engineering, installation, and testing of the System. The Contractor shall provide formal written evidence of current OEM certification(s) for the installer(s) as a part of the submittal or to the RE before being allowed to commence work on the System.

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**1.5 SUBMITTALS**

- A. Provide submittals in accordance with Specification Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES. The RE shall retain one copy for review and approval.
  - 1. If the submittal is approved the RE shall retain one copy for Official Records and return three (3) copies to the Contractor.
  - 2. If the submittal is disapproved, three (3) copies will be returned to the Contractor with a written explanation attached that indicates the areas the submittal deviated from the System specifications. The RE shall retain one copy for Official Records.
- B. Environmental Requirements: Technical submittals shall confirm the environmental specifications for physical TC areas occupied by the System. These environmental specifications shall identify the requirements for initial and expanded system configurations for:
  - 1. Floor loading for batteries and cabinets.
  - 2. Minimum floor space and ceiling heights.
  - 3. Minimum size of doors for equipment passage.
  - 4. Power requirements: The Contractor shall provide the specific voltage, amperage, phases, and quantities of circuits required.
  - 5. Air conditioning, heating, and humidity requirements. The Contractor shall identify the ambient temperature and relative humidity operating ranges required preventing equipment damage.
  - 6. Air conditioning requirements (expressed in BTU per hour, based on adequate dissipation of generated heat to maintain required room and equipment standards).
  - 7. Proposed floor plan, based on the expanded system configuration of the bidder's proposed EPBX for this FACILITY.
  - 8. Conduit size requirement (between main TC, computer, and console rooms).
  - 9. Main backbone, trunk line, riser, and horizontal cable pathways, cable duct, and conduit requirements between each MTC, TC, and TCO.
- C. Documents: The submittal shall be separated into sections for each subsystem and shall contain the following:
  - 1. Title page to include:
    - a. VA Medical Center.
    - b. Contractor's name, address, and telephone (including FAX) numbers.

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- c. Date of Submittal.
- d. VA Project No.
- 2. List containing a minimum of three locations of installations of similar size and complexity as identified herein. These locations shall contain the following:
  - a. Installation Location and Name.
  - b. Owner's or User's name, address, and telephone (including FAX) numbers.
  - c. Date of Project Start and Date of Final Acceptance by Owner.
  - d. System Project Number.
  - e. Brief (three paragraphs minimum) description of each system's function, operation, and installation.
- 3. Narrative Description of the system.
- 4. A List of the equipment to be furnished. The quantity, make, and model number of each item is required. Select the required equipment items quantities that will satisfy the needs of the system and edit between the // - //. Delete equipment items that are not required add additional items required, and renumber section as per system design. The following is the minimum equipment required by the system:

QUANTITY	UNIT
//As required//	Equipment (Radio Relay) Rack
//As required//	Cross Connection (CCS) Systems
//As required//	Wire Management System/Equipment
//As required//	Telecommunications Outlets (TCO)
//As Required//	Distribution Cables
//As required//	TCO Connection Cables
//As required//	System Connectors
//As required//	Terminators
//As required//	Telecommunications Closets (TC)
1 ea.	Installation Kit
//As-required//	Separate List Containing Each Equipment Spare(s)

- 5. Pictorial layouts of each MTC, IMTC, and RTCs; MCCS, IMCCS, VCCS, and HCCS termination cabinet(s), each distribution cabinet layout drawing, and TCO as each is expected to be installed and configured.

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6. Equipment technical literature detailing the electrical and technical characteristics of each item of equipment to be furnished.
7. Engineering drawings of the System, showing calculated signal levels at the EPBX output, each input and output distribution point, proposed TCO values, and signal level at each TCO multipin, fiberoptic, and coaxial cable jack.
8. List of test equipment as per paragraph 1.5.D. below.
9. Letter certifying that the Contractor understands the requirements of the SAMPLES Paragraph 1.5.E.
10. Letter certifying that the Contractor understands the requirements of Section 3.2 concerning acceptance tests.

**D. Test Equipment List:**

1. The Contractor is responsible for furnishing all test equipment required to test the system in accordance with the parameters specified. Unless otherwise stated, the test equipment shall not be considered part of the system. The Contractor shall furnish test equipment of accuracy better than the parameters to be tested.
2. The test equipment furnished by the Contractor shall have a calibration tag of an acceptable calibration service dated not more than 12 months prior to the test. As part of the submittal, a test equipment list shall be furnished that includes the make and model number of the following type of equipment as a minimum:
  - a. Signal Level Meter.
  - b. Volt-Ohm Meter.
  - c. Time Domain Reflectometer (TDR) with strip chart recorder (Data and Optical Measuring).
  - d. Bit Error Test Set (BERT).
  - e. Camera with a SD card with a minimum of 60 pictures to that will develop immediately to include appropriate test equipment adapters. A video camera in DVD format is an acceptable alternate.

**E. Samples:** A sample of each of the following items shall be furnished to the RE for approval prior to installation.

1. TCO Wall Outlet Box 4" x 4"x 2.5" with:
  - a. Two each telephone (or voice) rj45/11 jack installed.
  - b. Three each multi pin data rj45 jacks installed.
  - c. Cover Plate installed.

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- d. RF (F) installed.
  2. Data CCS patch panel, punch block or connection device with RJ45 connectors installed.
  3. Telephone CCS system with IDC and/or RJ45 connectors and cable terminal equipment installed.
  4. Fiber optic CCS patch panel or breakout box with cable management equipment and "ST" connectors installed.
  5. 610 mm (2 ft.) section of each copper cable to be used with cable sweep tags as specified in paragraph 2.4.H and connectors installed.
  6. 610 mm (2 ft.) section of each fiber optic cable to be used with cable sweep tags as specified in paragraph 2.4.H and connectors installed.
  7. 610 mm (2 ft.) section of each analog RF, video coaxial and audio cable to be used with cable sweep tags as specified in paragraph 2.4.H and connectors installed.
  8. Analog RF patch panel or breakout box with cable management equipment and "F" connectors installed.
- F. Certifications:
1. Submit written certification from the OEM indicating that the proposed supervisor of the installation and the proposed provider of the contract maintenance are authorized representatives of the OEM. Include the individual's exact name and address and OEM credentials in the certification.
  2. Submit written certification from the OEM that the wiring and connection diagrams meet National and/or Government Life Safety Guidelines, NFPA, NEC, UL, this specification, and JCAHCO requirements and instructions, requirements, recommendations, and guidance set forth by the OEM for the proper performance of the System as described herein. The VA will not approve any submittal without this certification.
  3. Preacceptance Certification: This certification shall be made in accordance with the test procedure outlined in paragraph 3.2.B.
- G. Equipment Manuals: Fifteen (15) working days prior to the scheduled acceptance test, the Contractor shall deliver four complete sets of commercial operation and maintenance manuals for each item of equipment furnished as part of the System to the RE. The manuals shall detail the

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theory of operation and shall include narrative descriptions, pictorial illustrations, block and schematic diagrams, and parts list.

H. Record Wiring Diagrams:

1. Fifteen (15) working days prior to the acceptance test, the Contractor shall deliver four complete sets of the Record Wiring Diagrams of the System to the RE. The diagrams shall show all inputs and outputs of electronic and passive equipment correctly identified according to the markers installed on the interconnecting cables, Equipment and room/area locations.
2. The Record Wiring Diagrams shall be in hard copy and two compact disk (CD) copies properly formatted to match the Facility's current operating version of Computer Aided Drafting (AutoCAD) system. The RE shall verify and inform the Contractor of the version of AutoCAD being used by the Facility.

I. Surveys Required As A Part Of The Technical Submittal: The Contractor shall provide the following surveys that depict various system features and capacities are required in addition to the on site survey requirements described herein. Each survey shall be in writing and contain the following information (the formats are suggestions and may be used for the initial Technical Submittal survey requirements), as a minimum:

1. Cable Distribution System Design Plan: A design plan for the entire cable distribution systems requirements shall be provided with this document. A specific cable count shall coincide with the total growth items as described herein. It is the Contractor's responsibility to provide the Systems entire cable requirements and engineer a distribution system requirement plan using the format of the following paragraph(s), at a minimum:

a. UTP (and/or STP) Requirements/Column Explanation:

Column	Explanation
FROM BUILDING	Identifies the building by number, title, or location, and main signal closet or intermediate signal closet cabling is provided from
BUILDING	Identifies the building by number, title, or location cabling is to be provided in
TO BUILDING IMC	Identifies building main terminal signal closet, by room number or location, to which cabling is provided too, in, and from

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FLOOR	Identifies the floor by number (i.e. 1st, 2nd, etc.) cabling and TCOs are to be provided
TC ROOM NUMBER	Identifies the floor signal closet room, by room number, which cabling shall be provided
ROOM NUMBER	Identifies the room, by number, from which cabling and TCOs shall be provided
NUMBER OF CABLE PAIR	Identifies the number of cable pair required to be provided on each floor designated OR the number of cable pair (VA Owned) to be retained
NUMBER OF STRANDS USED/SPARE	Identifies the number of strands provided in each run

**b. Fiber Optic Cabling Requirements/Column Explanation:**

Column	Explanation
FROM BUILDING	Identifies the building by number, title, or location, and main signal closet or intermediate signal closet cabling is provided from
TO BUILDING IMC	Identifies building, by number, title, or location, to which cabling is provided
FLOOR	Identifies the floor by number (i.e. 1st, 2nd, etc.)
TC ROOM NUMBER	Identifies the room, by number, from which cabling shall be installed
NUMBER OF STRANDS	Identifies the number of strands in each run of fiber optic cable
INSTALLED METHOD	Identifies the method of installation in accordance with as designated herein
NOTES	Identifies a note number for a special feature or equipment
BUILDING MTC	Identifies the building by number or title

**c. Analog RF Cabling Requirements/Column Explanation:**

Column	Explanation
FLOOR	Identifies the floor by number (i.e. 1st, 2nd, etc.)
TC ROOM NUMBER	Identifies the room, by number, from which cabling shall be installed
TO FLOOR TC	Identifies building, by number or location, to which cabling is installed

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NUMBER OF STRANDS	Identifies the number of strands in each run of RF cable
INSTALLED METHOD	Identifies the method of installation in accordance with as designated herein
NOTES	Identifies a note number for a special feature or equipment
BUILDING MTC	Identifies the building by number or title

3. Telecommunication Outlets: The Contractor shall clearly and fully indicate this category for each outlet location and compare the total count to the locations identified above as a part of the technical submittal. Additionally, the Contractor shall indicate the total number of spares.

**PART 2 - PRODUCTS**

**2.1 EQUIPMENT AND MATERIALS**

A. System Requirements:

1. The System shall provide the following minimum services that are designed in accordance with and supported by an Original Equipment Manufacturer (OEM), and as specified herein. The System shall provide continuous inter and/or intra-Facility voice and data, and analog RF service. The System shall be capacity sized so that loss of connectivity to external telephone systems shall not affect the Facilities operation in specific designated locations. The System shall:
  - a. Be capable of inter-connecting and functioning fully with the existing Local Telephone Exchange (LEC) Network(s), Federal Telephone System (FTS) Inter-city Network(s), Inter-exchange Carriers, Integrated Services Digital Network (ISDN), Electronic Private Branch Exchange (EPBX) switches, asynchronous/synchronous data terminals and circuits including Automatic Transfer Mode (ATM), Frame Relay, and local area networks (LAN), at a minimum.
  - b. Be a voice and data cable distribution system that is based on a physical "Star" Topology. An Analog RF coaxial cable distribution system shall be provided in a "home run" configuration from each associated riser TC to identified locations and as shown on the drawings.



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2. Cable Systems - Twisted Pair and Fiber optic, and Analog RF Coaxial:

a. General:

- 1) The Contractor shall be responsible for providing a new system conforming to current and accepted telephone and digital, and analog RF industrial/commercial cable distribution standards. The distribution cable installation shall be fully coordinated with the Facility, the PM, the RE and the Contractor prior to the start of installation.
- 2) The Contractor is responsible for complete knowledge of the space and cable pathways (i.e. equipment rooms, TCs, conduits, wireways, etc.) of the Facility. The Contractor shall at a minimum design and install the System using the Pathway Design Handbook H-088C3, TIA/EIA Telecommunications Building Wiring Standards, and Facility Chief of Information Resource Management's (IRM) instructions, as approved in writing by the PM and/or RE.
- 3) The System cables shall be fully protected by cable duct, trays, wireways, conduit (rigid, thin wall, or flex), and when specifically approved, flexible innerduct. It is the responsibility of the Contractor to confirm all contract drawings and the Facility's physical layout to determine the necessary cable protective devices to be provided. If flexible innerduct is used, it shall be installed in the same manner as conduit.
- 4) Cable provided in the system (i.e. backbone, outside plant, inside plant, and station cabling) shall conform to accepted industry and OEM standards with regards to size, color code, and insulation. The pair twists of any pair shall not be exactly the same as any other pair within any unit or sub-unit of cables that are bundled in twenty-five (25) pairs or less. The absence of specifications regarding details shall imply that best general industry practices shall prevail and that first quality material and workmanship shall be provided. Certification Standards, (i.e., EIA, CCITT, FIPPS, and NFPA) shall prevail.
- 5) Some areas of this Facility may be considered "plenum". All wire and cable used in support of the installation in those

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areas (if any) shall be in compliance with national and local codes pertaining to plenum environments. It is the responsibility of the Contractor to review the VA's cable and wire requirements with the RE and the IRM prior to installation to confirm the type of environment present at each location.

- 6) The Contractor shall provide outside and inside plant cables that furnishes the number of cable pairs required in accordance with the System requirements described herein. The Contractor shall fully coordinate and obtain approval of the design with the OEM, RE and the IRM prior to installation.
- 7) All metallic cable sheaths, etc. shall be grounded by the Contractor (i.e.: risers, underground, station wiring, etc.) as described herein.
- 8) If temporary cable and wire pairs are used, they shall be installed so as to not present a pedestrian safety hazard and the Contractor shall be responsible for all work associated with the temporary installation and for their removal when no longer necessary. Temporary cable installations are not required to meet Industry Standards; but, must be reviewed and approved by the RE and the IRM prior to installation.
- 9) Conductors shall be cabled to provide protection against induction in voice and data, and analog RF circuits. Crosstalk attenuation within the System shall be in excess of -80 dB throughout the frequency ranges specified.
- 10) Measures shall be employed by the Contractor to minimize the radiation of RF noise generated by the System equipment so as not to interfere with audio, video, data, computer main distribution frame (MDF), telephone customer service unit (CSU), and electronic private branch exchange (EPBX) equipment the System may service.
- 11) The System's cables shall be labeled on each end and been fully tested and certified in writing by the Contractor to the RE before proof of performance testing can be conducted. The as-installed drawings shall identify each cable as labeled, used cable, and bad cable pairs. Minimum test requirements are for impedance compliance, inductance, capacitance, signal

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level compliance, opens, shorts, cross talk, noise, and distortion, and split pairs on all cables in the frequency ranges specified. The tests required for data cable must be made to guarantee the operation of this cable at not less than 10 mega (m) Hertz (Hz) full bandwidth, fully channel loaded and a Bit Error Rate of a minimum of  $10^{-6}$  at the maximum rate of speed. All cable installation and test records shall be made available at acceptance testing by the RE or Contractor and thereafter maintained in the Facility's Telephone Switch Room. All changes (used pair, failed pair, etc.) shall be posted in these records as the change occurs.

- 12) The Contractor shall coordinate with the RE and the IRM to provide all cable pairs/circuits from the Facility Telephone Switch Room and establish circuits throughout the Facility for all voice, data, computer alarm (except fire alarm), private maintenance line, Radio Paging, PA, LAN, DHCP, and any low voltage circuits as described herein.
  - 13) The Contractor shall provide proper test equipment to guarantee that cable pairs and analog RF coaxial cable meet each OEM's standard transmission requirements, and guarantee the cable will carry data transmissions at the required speeds, frequencies, and fully loaded bandwidth.
  - 14) The Contractor shall coordinate with the Facility Chief of Medical Media Production Service (MMPS) to install baseband analog RF, cables and circuits from each TC to designated TCO locations and as shown on the drawings. The Contractor shall work with the Facility Chief of MMPS to establish circuits throughout the Facility and shall provide proper test equipment to guarantee that analog RF, cables meet each OEM's standard transmission requirements, and guarantee the cables will carry analog video and audio transmissions at the required speeds, frequencies, and fully loaded bandwidth.
- b. Telecommunications Closets (TC): In TC's that are served with both a UTP backbone cable and a fiber optic backbone cable, the UTP cable shall be terminated on separate RJ-45, 8-pin connectors with 110A or equivalent type punch down blocks located on the back or front of a 48-port modular patch panel dedicated to data

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applications. Only the UTP backbone cable pairs, identified as being connected to the fiber optic backbone, shall be extended to the fiber optic interface device. All connecting cables required to extend these cables (i.e. patch cords, twenty-five pair connectors, etc.), to the fiber optic interface device, in the TC's shall also be provided by the Contractor to insure a complete and operational fiber optic distribution system:

- 1) In TC's, which are only served by a backbone cable, the cable shall be terminated on separate modular connecting devices (110A or equivalent) that are dedicated to data applications. In order to provide full service to all data cable pairs as identified in each TC/cabinet including spare capacity noted herein, the size of all vertical (riser) cables and/or outside cables serving these TC's shall be increased as required.

c. Backbone and Trunk Cables:

- 1) The Contractor shall identify, in the technical submittal, the voice and data (analog RF coaxial cable shall not be provided in main trunk or backbone lines) connecting arrangements required by the LEC for interconnection of the System to the commercial telephone and FTS networks. The Contractor shall provide all required voice and data connecting arrangements.
- 2) All submitted equipment shall meet or exceed standards, rules, and regulations of the Federal Communications Commission (FCC) and shall be capable of operating without outboard or "extra" devices. The Contractor shall identify the FCC registration number of the System equipment, in the technical submittal.

d. Riser Cable:

- 1) All communication riser cables shall be listed as being suitable for the purpose and marked accordingly per Articles 517, 700, and 800 of the NEC.
- 2) All voice and data communication (analog RF coaxial cable is not to be provided in riser systems) riser cables shall be STP or Unshielded Twisted Pair (UTP), minimum 24 American Wire Gauge (AWG) solid, thermoplastic insulated conductors. They shall be enclosed with a thermoplastic outer jacket.
- 3) The Contractor shall provide and install inside riser cables to insure full service to all voice cable pairs identified in

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each TC terminating enclosure plus not less than 50% additional spare capacity.

- 4) The complete riser cabling system shall be labeled and tested as described herein.
- e. Horizontal and Station Cable:
- 1) Three (3) Four Pair (4) UTP 24 AWG station wiring cables shall be installed from the top (3) TCO jacks to the TC and shall be of a type designed to support Category 6 communications (250 mega-Hertz [mHz] or above). At the jack location, terminate all four pair on the RJ-45 jack. At the signal closet, all four pair shall be terminated on the modular punch down blocks dedicated to telephone applications.
  - 2) A Four (4) UTP 24 AWG (in thermoplastic jacket unless otherwise specified by RE) station wiring cable shall be installed from each of the two (2) bottom TCO RJ-11 jacks (shall conform to EIA/TIA 568 Standard "T568A" and NFPA) to the TC and shall be of a type designed to support Category 6 communications (250 mHz or above).
- f. Telecommunication Outlets (TCO), Jacks: All TCO's shall have a minimum of three (3) RJ-45 type jacks. Two bottom jacks shall be an eight pin RJ-45/11 compatible jack, labeled, and designated for telephone applications only. The top three jacks shall be eight pin RJ-45 type unkeyed (sometimes called center keyed) jacks, labeled, and designated for data.
- g. Patient Bedside Prefabricated Units (PBPUs): Where PBPUs exist in the Facility, the Contractor shall identify the single gang "box" location on the PBPUs designated for installation of the telephone jack. This location shall here-in-after be identified as the PBTCO. The Contractor shall be responsible for obtaining written approval and specific instructions from the PBPUs OEM regarding the necessary disassembly and reassembly of each PBPUs to the extent necessary to pull wire from above the ceiling junction box to the PBPUs box reserved for the PBTCO. A Contractor provided stainless steel cover plate approved for use by the PBPUs OEM and Facility IRM Chief shall finish out the jack installation. Under no circumstances shall the Contractor proceed with the PBPUs installations without the written approval of the PBPUs OEM and

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the specific instructions regarding the attachment to or modifying of the PBPU. The RE shall be available to assist the Contractor in obtaining these approvals and instructions in a timely manner as related to the project's time constraints. It is the responsibility of the Contractor to maintain the UL integrity of each PBPU. If the Contractor violates that integrity, it shall be the responsibility of the Contractor to obtain on site UL re-certification of the violated PBPU at the direction of the RE and at the Contractor's expense.

**h. Fiber Optics:**

- 1) A complete fiber optic cable distribution system shall be provided as a part of the System. The Contractor shall provide a fiber optic cable that meets the minimum bandwidth requirements for FDDI, ATM, and Frame Relay services. This fiber optic cable shall be a 50/125 micron multi-mode, containing a minimum of 6 strands of fiber, unless otherwise specified, and shall not exceed a distance of 2,000 Meters (M), or 6,560 feet (ft.) in a single run. Tight buffered fiber cable shall be used for indoor runs. The multimode fibers shall be terminated and secured at Equipment Room end in "ST" type female stainless steel connectors installed in an appropriate patch or breakout panel with a cable management system. A 610 mm (2 ft.) cable loop (minimum) shall be provided at each end to allow for future movement. Telecommunications room end shall be terminated in "LC" type female stainless steel connectors installed in patch panel with a cable management system.
- 2) In addition, a 6 strand (minimum), 8.3 mm single mode fiber optic cable shall be provided. Single mode fibers shall be terminated and secured at Equipment Room end with "ST" type female stainless steel connectors installed in an appropriate patch or breakout panel. The panel shall be provided with a cable management system. A 610 mm (2 ft.) cable loop (minimum) shall be provided at each end to allow for future movement. Telecommunications room end shall be terminated in "LC" type female stainless steel connectors installed in patch panel with a cable management system.

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- 3) The fiber optic backbone shall use a conventional hierarchical "star" design where each TC is wired to the primary hub (main cross-connect system) or a secondary hub (intermediate cross-connect system) and then to the primary hub. There shall be no more than two hierarchical levels of cross-connects in the backbone wiring. Each primary hub shall be connected and terminated to a CCS in the Telephone Switch Room. Additionally, a parallel separate fiber optic interconnection shall be provided between the Telephone Switch Room CCS and the MDF in the Main Computer Room.
- 4) In the TC's, Telephone Switch Room, and Main Computer Room, all fiber optic cables shall be installed in a CCS and/or MDF rack mounted fiber optic cable distribution component/splice case (Contractor provided and installed rack), patch, or breakout panel in accordance with industry standards. Female "LC" and "ST" connectors shall be provided and installed on the appropriate panel for termination of each strand.
- 5) The Contractor shall test each fiber optic strand. Cable transmission performance specifications shall be in accordance with EIA/TIA standards. Attenuation shall be measured in accordance with EIA fiber optic test procedures EIA/TIA-455-46, -61, or -53 and NFPA. Information transmission capacity shall be measured in accordance with EIA/TIA-455-51 or -30 and NFPA. The written results shall be provided to the RE for review and approval.

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3. Specific Subsystem Requirements: The System shall consist, as a minimum, of the following independent sub-systems to comprise a complete and functional voice and digital and analog RF telecommunications cabling system: "Main" (MTC), "intermediate" (IMTC), and "riser" (RTC) TC's; "backbone" cabling (BC) system; "vertical" (or "riser") trunk cabling system; "horizontal" (or "lateral") sub-trunk cabling system, vertical and horizontal cross-connection (VCC and HCC respectively) cabling systems, and TCO's with a minimum of five (5) RJ-45 jacks for the appropriate telephone, Data connections, and additional jacks, connectors, drop and patch cords, terminators, and adapters provided.

a. Telecommunication Closet (TC):

- 1) There shall be a minimum of one TC for the MTC, each building IMTC, and each RTC per building floor location. However, in large building(s), where the horizontal distance to the farthest voice and digital work area may exceed 90 Meters (M) (or 295 feet [ft]), additional TC's shall be provided as described herein. The maximum DC resistance per cable pair shall be no more than 28.6 Ohms per 305 M (1,000 feet). Each TC shall be centrally located to cover the maximum amount of local floor space. The TC's house in cabinets or enclosures, on relay racks, and/or on backboards, various telecommunication data equipment, controllers, multiplexers, bridges, routers, LAN hub(s), telephone cross-connecting, active and passive equipment.
- 2) Additionally, the TC's may house fire alarm, nurses call, code one (or blue), video, public address, radio entertainment, intercom, and radio paging equipment. Regardless of the method of installation, mounting, termination, or cross-connecting used, all backbone, vertical, and horizontal copper and fiber optic and analog RF coaxial cables shall be terminated on appropriate cross-connection systems (CCS) containing patch panel(s), punch blocks, and/or breakout devices provided in enclosures and tested as described herein. A cable and/or wire management system shall be a part of each CCS.
  - a) A minimum of three 110-120 VAC active quad outlets shall be provided, each with "U" grounded receptacles at a minimum



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of one outlet for each front, side and back wall. These outlets shall be separately protected by an AC circuit breaker provided in the designated Government Emergency Critical Care AC power panel, that is connected to the Facilities Emergency AC Power Distribution System. For larger building TC applications, a minimum of one additional quad AC outlet shall be provided for every 800M<sup>2</sup> (or 8,000 ft<sup>2</sup>) of useable floor space. Additional outlets shall be equally spaced along the wall.

- b) Climate control shall be provided in each TC 24 hours a day, seven days per week and 52 week per year to prevent failure of electronic components and for mission critical functional applications. The RE and/or Facility Chief Engineering Officer are responsible for informing the Contractor regarding the minimum climate control requirements. In identified hostile TC locations where it has been determined (by the RE or Facility Chief Engineer) that proper TC climate or external signal radiation cannot be properly maintained or controlled, the Contractor may, at his/her option, provide a minimum of two individual and properly sized self contained climate controlled equipment cabinet enclosures; one designated for voice, and one designated for data, and one additional cabinet designated for analog RF service, in each TC location identified on the drawings, in lieu of providing additional required TC air handling capability.

b. Cross-connect Systems (CCS):

- 1) The CCS shall be selected based on the following criteria:  
requires the use of a single tool, has the fewest amount of parts, and requires the least amount of assembly or projected trouble shooting time during the life of the system.
- 2) The CCS system used at the MTC, each IMTC, and each TC shall force cross-connect cable slack management through adherence to the OEM's installation methods, provided cable management systems, and as described herein, so that moves, adds, and changes can be administered easily and cost effectively.

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- 3) Copper Cables: The MTC, each IMTC, and TC shall contain a copper CCS sized to support the System TCO's and connections served by each individual TC and as shown on the drawings. The System layout shall allow for a minimum of 50% anticipated growth. Additionally, each CCS must provide maximum flexibility, while maintaining performance, in order to meet system-changing requirements that are likely to occur throughout its useful life.
- 4) Fiber Optic Cables:
  - a) The MTC and each TC shall contain a fiber CCS sized to support the System TCO's and connections served by each individual TC and as shown on the drawings. The System layout shall allow for a minimum of 50% anticipated growth.
  - b) Each fiber CCS must provide maximum flexibility and cable management while maintaining performance in order to meet changing requirements that are likely to occur throughout the expected life of the system. All fiber optic cable slack shall be stored in protective enclosures.
  - c) If it is determined that a fiber optic distribution system is not necessary for the immediate system needs. Each TC shall be provided with fiber optic cable(s) that contain a minimum of 12 strands "dark" multimode fiber and 6 strands "dark" single mode fiber, each fiber properly terminated on its respective female stainless steel connector mounted in an appropriate fiber termination enclosure provided in each TC.
- 5) The Contractor shall not "cross-connect" the copper or fiber optic cabling systems and subsystems even though appropriate "patch" cords are to be provided for each "patch", "punch", or "breakout" panel. In addition, the Contractor shall not provide active electronic distribution or interface equipment as a part of the System.
- 6) Grounding: Proper grounding and bonding shall be provided for each TC and all internal equipment. Reference shall be made to proper codes and standards, such that all grounding systems must comply with all applicable National, Regional, and Local

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Building and Electrical codes. The most stringent code of these governing bodies shall apply.

- a) If local grounding codes do not exist for the System location, then at a minimum, a #6 American Wire Gauge (AWG) stranded copper wire, or equivalent copper braid, shall be connected to a separate earth grounding system for each TC (the looping of TC's in a general location is allowed as long as the specifications contained herein are met). Under no circumstance shall the AC neutral be used for this ground. See PART 3 - EXECUTION for specific grounding instructions.
- c. Main Cross-connection Subsystem (MCCS): The MCCS shall be located in the MTC and it shall be the common point of appearance for inter and intra-building copper and fiber optic "backbone" system cables, and connections to the telephone and data cable systems. The MTC usually houses telephone EPBX, public address, radio paging interface, routers, and main hierarchical data LAN concentrating equipment. Additionally, it shall provide a single administration and management point for the entire System.
- d. Voice (or Telephone) Cable Cross-Connection Subsystem:
  - 1) Due to the usually high number of copper cable termination's required at the MCCS, Insulation Displacement Connection (IDC) hardware shall be used. Termination options shall include the following for a Category 6 Cabling System: IDC termination of cross-connection wire(s), IDC patch cord connector to IDC patch cord connector, and hybrid modular cord to IDC patch cord connector shall be the minimum provided.
  - 2) Additionally, due to the large or many MCCS (at initial installation and over the life of the System) copper termination points, the CCS that makes the best use of real estate while still following the OEM design and installation guidelines, and meeting the specifications described herein, shall be provided.
  - 3) For ease of maintenance purposes, all terminations shall be accessible without the need for disassembly of the IDC wafer. IDC wafers shall be removable from their mounts to facilitate testing on either side of the connector. Designation strips or

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labels shall be removable to allow for inspection of the terminations. The maximum number of terminations on a wall or on a rack frame or panel shall comply with the OEM recommendations and guidelines, and as described herein. A cable management system shall be provided as a part of the IDC.

- 4) IDC connectors shall be capable of supporting cable re-terminations without damaging the connector and shall support a minimum of 200 (telephone equipment standard compliant) IDC insertions or withdrawals on either side of the connector panel.
  - 5) A non-impact termination method using a full-cycle terminating tool having both a tactile and an audible feedback to indicate proper termination is required. For personnel safety and ease of use in day to day administration, high impact installation tools shall not be used.
  - 6) UTP or STP cross connecting wires shall be provided for each "pair" of connection terminals plus an additional 50% spare.
- e. Data Cross-Connection Subsystems:
- 1) The MCCS shall be a Main Distribution Terminating (MDT) data unit and shall be provided in the MTC. The MDT shall consist of a "patch" panel(s) provided with modular RJ45 female connectors for cross-connection of all copper data cable terminations. The panels shall provide for system grounding (where no dielectric cables are used) and be provided with a cable management system.

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- 2) Each panel shall conform to EIA dimensions and be suitable for mounting in standard equipment racks, have the RJ45 jacks aligned in two horizontal rows (up to a maximum of 48 jacks per panel), and shall not exceed the OEM's recommendations. Each RJ45 jack shall be of modular design and capable of accepting and functioning with other modular (i.e. RJ11) plugs without damaging the jack. It is not necessary to provide a jack for unused positions that are not part of the 50% expansion requirement.
    - a) All data system inputs from the server(s), data LAN, bridge, or interface distribution systems shall appear on the "top" row of jacks of the appropriate patch panel.
    - b) All System outputs or backbone cable connections shall appear on the "bottom" row of jacks of the same patch panel.
  - 3) A patch cord shall be provided for each system "pair" of connection jacks. Each patch cord shall have modular RJ45 connectors provided on each end to match the panel's modular RJ45 female jack's being provided.
- f. Fiber optic Cross-Connection Subsystems: The MTC shall be provided with a separate fiber MCCC. Each TC shall be provided with a rack mounted patch or distribution panel that is installed inside a lockable cabinet or "breakout enclosure" that accommodates a minimum of 12 strands multimode fiber and 12 strand single mode fiber (these counts shall not be included the 50% spare requirement). Two of the single mode fibers shall be designated for educational analog video applications. A cable management system shall be provided for each panel.
- 1) The panel(s) shall contain a minimum of 24 female "ST" connectors, be able to accommodate splices and field mountable connectors and have capacity for additional connectors to be added up to the OEM's maximum standard panel size for this type of use. All patch panel sides, including the front and back, shall be protected by a cabinet or enclosure.
  - 2) The panel(s) shall conform to EIA dimensions and be suitable for installation in standard racks, cabinets, and enclosures.

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The panels shall provide for system grounding (where no dielectric cables are used).

- 3) The patch panel with the highest OEM approved density of fiber "ST" termination's (maximum of 72 each), while maintaining a high level of manageability, shall be selected. Patch cables, with proper "LC" or "ST" connectors installed on each end shall be provided for each pair of fiber optic cable "LC" or "ST" connectors.
  - a) All System "inputs" from interface equipment or distribution systems shall appear on the "top" row of connectors of the appropriate patch panel.
  - b) All System "outputs" or backbone cable connections shall appear on the "bottom" row of connectors of the same patch panel.
- 4) In order to achieve a high level of reliability that approximates that of an OEM connector, field installable connectors shall have an OEM specified physical contact polish. Every fiber cable shall be terminated with the appropriate connector, and tested to ensure compliance to OEM and specifications outlines herein. Where a local fiber optic system connector standard, Industry Standard fiber optic "LC" or "ST" female connector terminated with a fiber optic cable, shall be used. But, if the fiber optic cable is not used (or "dark"), a "LC" or "ST" male terminating "cap" shall be provided for each unused "LC" or "ST" female connector.
- g. Intermediate Cross-connection Subsystems (IMCCS): The MTC and each IMTC shall be provided with an IMCCS that shall be the connection point between the MCCA system and the distribution backbone cable and the IMCCS, that is located in one or more buildings on a campus, where each IMCCS is placed by system design. For a technical explanation of internal equipment and system requirements, refer to the above MTC and MCCA paragraphs.
- h. Distribution Cable Systems / Backbone Cable System (Common to Inter-buildings): The backbone cable system extends from the MCCA to each IMCCS to establish service between buildings on a campus. The media (copper and fiber optic) used in the BC system shall be designed according to the system requirements, OEM standards and

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guidelines, and as described herein. A multi-pair copper for voice and data, and separate multiple fiber optic backbone system shall be provided as a part of the BC distribution system.

- 1) The copper cable system shall be configured as a "Star" Topology with separate dedicated cables between the MCCA and each IMCCA.
  - 2) UTP and STP copper cables shall consist of thermoplastic insulated conductors formed into binder groups. The groups are to be identified by distinctly colored binders and assembled to form a single compact core covered by a protective sheath. Each cable shall be rated for Category 6 Telecommunications System Service. A minimum of eight pairs per circuit, plus an additional 50% spare for growth shall be provided.
  - 3) Where the distance limitations of UTP or STP may be exceeded, multimode (or single mode) fiber optic cable(s) shall be used to augment the voice and/or data backbone cable system(s). The total loss of each fiber shall not exceed 12 decibel (dB) at 850 nano-Meter (nm), 11 dB at 1,300 nm, or 10 dB at 1,500 nm.
  - 4) A patch cord shall be provided for each system "pair" of connection jacks. Each patch cord shall have modular connectors provided on each end to match the panel's modular female jack.
  - 5) The fiber optic BC system shall be configured as a "Bus" Topology with separate dedicated fibers between the MCCA and each IMCCA. The System shall be sized to meet the system requirements plus an expansion capability of 50%. Fiber optic cable(s) having a minimum of 12 strands multimode fiber and 6 strands single mode fiber shall be provided. 6) All BC shall be identified with permanent labels at both ends. Labels will indicate system, floor, closet, and zone. The label designations shall match those used for cross-connect terminals and patch panels.
- i. Distribution (Common to Intra-Building) Cabling Systems: The intra-building trunk cabling system provides for connection between the IMCCA and each Riser TC's provided vertical cross-connecting system (VCCA) within a building. The media (copper, fiber optic, and RF coaxial) used in the intra-building backbone

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cabling system shall be designed according to the system requirements, OEM standards and guidelines, and as described herein. A multi-pair copper for voice and data, and separate multiple fiber optic, and analog RF coaxial trunk system shall be provided as a part of the System.

- 1) Category 6 UTP or STP multi-pair trunk cable(s) shall be used in the voice and data trunk-line-cabling systems. A minimum of eight pairs per circuit, plus an additional 50% spare for growth shall be provided.
- 2) Where the distance limitations of UTP and/or STP will be exceeded, multimode (or single mode) fiber optic cable shall be used in the voice and/or trunk cabling systems. The total loss of the fiber trunks shall not exceed 12 dB at 850 nM , 11 dB at 1,300 nM, or 10 dB at 1,500 nM.
  - a) All voice system "outputs" from the IMCCS to the trunk-line distribution system shall appear on the "right" side of IDC (minimum 110A blocks) punch terminals of the IMCCS.
  - b) All data system "outputs" from the IMCCS to the trunk-line distribution system shall appear on the "bottom" row of jacks of the same IDC (minimum 110A blocks) of the IMCCS.
  - c) A patch cord shall be provided for each system "pair" of connection jacks. Each patch cord shall have modular connectors provided on each end to match the panel's modular female jack.
- 3) The fiber optic trunk line system shall be configured as a "Buss" Topology with separate dedicated fibers between the IMCCS and each RCS. The System shall be sized to meet the System requirements with a expansion capability of 50% provided. Separate individual fiber optic cable(s) with a minimum of 18 strands multimode fiber and/or 12 strands single mode fiber shall be provided. Two of the single mode fibers shall be designated for analog video service.



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- 4) All trunk lines shall be identified with permanent labels at both ends. Labels will indicate system, floor, closet, and zone. The label designations shall match those used for cross-connects and patch panels.
  - a) All System outputs from the IMCCS to the trunk-line distribution system shall appear on the "bottom" row of "ST" connectors in the appropriate patch panel.
  - b) A patch cord shall be provided for each system "pair" of connection "ST" connectors. As a minimum, each patch cord shall have "ST" male connectors provided on each end to match the panel's female "ST" connector provided.
- j. VCCS and Horizontal Cross-connecting (HCCS) Systems: Each TC shall be provided with a separate VCCS and HCCS located within the TC. The VCCS and HCCS shall interconnect and interface the riser (vertical) trunk line cables with the horizontal (or station) sub-trunk line cables. The media (copper, fiber optic and analog RF coaxial) used in the CCS system shall be designed according to the System requirements, OEM standards and guidelines, and as described herein. A multi-pair copper for voice and data, and separate multiple fiber optic and RF coaxial CCS system shall be provided as a part of the System.
  - 1) The UTP, fiber optic and RF coaxial trunk-line cabling systems are that connected between the trunk-lines and Riser VCCS, shall be terminated:
    - a) On the "left" or "top" IDC (or 110A blocks) for each UTP or STP voice cable.
    - b) On the "top" row of RJ45 jacks on the appropriate patch panel for each UTP or STP data cable.
    - c) On the "top" row of "ST" connectors on the appropriate patch panel for each fiber and "F" connectors for each analog RF coaxial cable.

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- 2) The UTP, STP, and fiber optic and analog RF coaxial sub-trunk (lateral) floor distribution cabling systems that are connected between each RTC and each TCO or secondary system distribution or connection point, shall terminate on an appropriate HCCS, at the:
  - a) On the "right" IDC (or 110A block) used as the VCCS input for each UTP or STP voice cable.
  - b) On the "bottom row of RJ45 jacks on the appropriate patch panel used as the VCCS input for each UTP or STP data cable.
  - c) On the "bottom" row of "ST" connectors on the appropriate patch panel used as the VCCS input for each fiber and "F" connectors for each analog RF coaxial cable.
  - d) The technical requirements of the VCCS and HCCS "patch", "terminating", or "breakout" panels and cable management assemblies for voice, data and fiber optic ( and RF coaxial) cables shall be as described in the above MCCS, IMCCS, and TC technical paragraphs.
- 3) The Contractor shall not "cross-connect" the VCCS or HCCS cabling systems even though appropriate patch cords are provided for each "patch", "punch", or "breakout" panel. Also, the Contractor shall not provide active interface or distribution electronic equipment as a part of the System.
- 4) The analog RF coaxial cabling systems shall be connected between each IMCS and RTC shall terminate on the VCCS on the "top" row of "F" connectors on an appropriate patch panel. Additionally, each horizontal distribution analog RF coaxial cable shall terminate on the HCCS on the "bottom" row of "F" connectors of the same panel.
- 5) The analog RF terminating panel(s) shall be the "patch" type. Each panel shall be the 19" EIA rack dimensions and provided with a minimum of 12 double female "F" connector rows. Each patch panel shall be provided with the expansion capability of a maximum of 24 double row "F" slots that can be field activated.

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- 6) Each analog RF "patch" panel shall be provided inside a lockable cabinet or enclosure. Stacking of the "patch" panels is permitted as long as installation guidelines are met.
- k. Horizontal (or Station) Cabling (HC): The HC distribution cabling systems connects the distribution field of the voice and data HCCS, in a "Star" Topology, to each TCO or connector and as shown on the drawings via the sub-trunk system.
  - 1) Horizontal cables shall consist of insulated, UTP or STP conductors that are rated for Category 6 telecommunications service for voice and data systems.
  - 2) The number of UTP or STP distribution pairs dedicated to each floor from the HC shall be sufficient to accommodate all the horizontal voice and data circuits served by the distribution cable to each TCO.
    - a) A minimum of four pairs for voice shall be connected to the "right" side of the IDC (or 110A block) that the VCCS "input" connections appear in the RTC.
    - b) A minimum of two separate sets of four pairs each for data shall be connected to the "bottom" row of RJ45 jacks that the VCCS "input" connections appear in the RTC.
  - 3) The horizontal cable length to the farthest system outlet shall be limited to a maximum of 90M (or 295 ft). These maximum lengths must be derated, adjusted and reduced to include cross-connection and distribution system losses. Additional TC(s) shall be provided on large floor areas of buildings to limit the horizontal distribution to a maximum of 90M (or 295 ft).
  - 4) The splitting of pairs within a cable between different data jacks shall not be permitted.
  - 5) The installation of the HC shall conform to appropriate OEM recommendations and standards outlined herein. This requirement will insure adequate protection for Electro-Magnetic Interference (EMI) sources.
  - 6) A system design where "looping" the HC distribution cables from room to room shall not be permitted.
  - 7) The number of fiber optic cables dedicated from the "bottom" row of "ST" connectors of the appropriate patch panel that the

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VCCS "input" connections were made, to each floor shall be sufficient to accommodate all the horizontal TCO's served by the distribution cable system in a "home run" configuration minimum of two cables (one multimode and one single mode) per each TCO and as shown on the drawings. 8) The analog RF coaxial cables dedicated from the "bottom" row of "F" connectors of the appropriate VCCS patch panel where the "input" connections were made, to each floor TCO shall provided in the "home run" configuration and be sufficient to accommodate all the TCO's served by the HC distribution cable system minimum of one analog RF coaxial cable shall be provided for each TCO circuit and as shown on the drawings).

1. System Telecommunication Outlets (TCO): The System shall be capable of receiving the specified telephone (or voice) and data signals acquired from the LEC, FTS contracted carrier and computer system, and one each analog RF cable and shall process and distribute them to the designated TCO's and as shown on the drawings. At a minimum, one TCO shall be provided on each room wall, associated with an active 120 VAC shall be provided and as shown on the drawings. The only exception to the general rule, of one outlet per wall, shall be those "special" locations (e.g., surgical suites, radiology MRI rooms, labs, patient bed rooms, warehouse, loading docks, storage rooms, etc.) where there is usually only one TCO provided as designated on the drawings.
  - 1) Each TCO shall consist of five multipin modular RJ45/11 jacks, two designated for telephone and three for data service. Each TCO with appropriate jacks installed shall be provided by the Contractor in each designated location and as shown on the drawings.
  - 2) The Contractor shall connect each telephone multipin modular RJ45 jack to a separate "right side as you look at it" telephone HC distribution system HCCS "punch down" 110A block or approved IDC terminating device in each associated RTC. The modular RJ45 jack shall be able to accept and operate with smaller modular RJ11 plugs while providing proper connection and not damaging the modular jack. he OEM shall warrant all

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modular RJ45/11 jacks in such a manner to be usable for modular RJ11 plugs.

- 3) The Contractor shall connect each TCO data multipin modular RJ45 jack to a separate lower row jack on the HCCS "patch panel" in each associated RTC. The Contractor is not to "cross-connect" VCCS and HCCS data distribution cables or provides active electronic data distribution equipment as a part of the System.
- 4) A non-impact termination method, using either a stuffer cap with installation tool or full-cycle terminating tool having both tactile and audible feedback to indicate proper termination shall be used. High impact installation tools shall not be used.
- 5) Each terminated conductor end shall be properly trimmed to assure a minimum clearance of 6.35 mm (0.250 in) clearance between the conductors of adjacent modules.
- 6) The multipin RJ45 jack shall be modular in construction that will accept and operate with a modular UTP and STP RJ45 connector and its pin assignments.
- 7) The Contractor shall connect each fiber optic TCO "ST" or "LC" connector to a separate fiber optic "bottom" row "ST" or "LC" connector HCCS "patch panel" or "breakout" terminating device in each associated TC. The Contractor is not to "interconnect" VCCS and HCCS fiber optic distributions cables or provide active fiber optic electronic distribution equipment as a part of the system.
- 8) The Contractor shall connect each analog RF cable to a female "F" connector provided on each TCO and as shown on the drawings and to each bottom row of "F" connectors on the HCCS patch panel(s) serving the area. The Contractor is not to "interconnect" VCCS and HCCS analog RF distribution cables OR provides active analog RF distribution equipment as a part of the System.

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**B. System Performance:**

1. At a minimum, the System shall be able to support the following voice and data operations for Category 6 Certified Telecommunication Service:
  - a) Wide (or Broad) Band:
    - 1) All channels: 140 mega(m)-Bps, minimum, capable to 565 mBps at "T" reference.
2. At a minimum the System shall support the following operating parameters:
  - a. Telecommunications Outlet (TCO):
    - 1) Voice:
      - a) Isolation (outlet-outlet): 24 dB.
      - b) Impedance: 600 Ohms, balanced (BAL).
      - c) Signal Level: 0 deciBel per mili-Volt (dBmV)  $\pm$  0.1 dBmV.
      - d) System speed: 100 mBps, minimum.
      - e) System data error: 10 to the -6 Bps, minimum.
    - 2) Data:
      - a) Isolation (outlet-outlet): 24 dB.
      - b) Impedance: 600 Ohms, BAL.
      - c) Signal Level: 0 dBmV  $\pm$  0.1 dBmV.
      - d) System speed: 120 mBps, minimum.
      - e) System data error: 10 to the -8 Bps, minimum.
    - 3) Fiber optic:
      - a) Isolation (outlet-outlet): 36 dB.
      - b) Signal Level: 0 dBmV  $\pm$  0.1 dBmV.
      - c) System speed: 540 mBps, minimum.
      - d) System data error: 10 to the -6 BPS, minimum.
  - 4) Analog RF Service: Broadcast or "off air" RF (or television) analog service is considered to be at RF (below 900 mHz in frequency bandwidth). Usually a RF television circuits require a single coaxial cable plant from the headend to each TC location.
    - a) Isolation (outlet-outlet): 14 dB.
    - b) Impedance: 75 Ohms, Unbalanced (UNBAL).
    - c) Signal Level: 10 dBmV  $\pm$  5.0 dBmV.
    - d) Bandwidth: 6.0 mHz per channel, fully loaded //

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- 5) Closed Circuit Analog Video Service: Analog video service is considered to be at baseband (below 100 mHz in frequency bandwidth). An analog video circuit requires a separate analog video from the audio connector. The following minimum operating parameters shall be capable over each installed analog video circuit:
- a) Impedance: 75 Ohm, unbalanced.
  - b) Output Level: 1.0 V peak to peak (P-P), for 87.5% depth of Modulation (Mod).
  - c) Diff Gain:  $\pm 1$  dB at 87.5% Mod.
  - d) Diff Phase:  $\pm 1.5$  at 87.5% Mod.
  - e) Signal to Noise (S/N) ratio: 44 dB, minimum.
  - f) Hum Modulation: -55 dB.
  - g) Return Loss: -14 dB (or 1.5 Voltage Standing Wave Ratio [VSWR]), maximum.
  - h) Isolation (outlet-outlet): 24 dB, minimum.
  - i) Bandwidth: 6.0 mHz per channel, fully loaded, minimum.

**C. General:**

1. All equipment to be supplied under this specification shall be new and the current model of a standard product of an OEM or record. An OEM of record shall be defined as a company whose main occupation is the manufacture for sale of the items of equipment supplied and which:
  - a. Maintains a stock of replacement parts for the item submitted.
  - b. Maintains engineering drawings, specifications, and operating manuals for the items submitted.
  - c. Has published and distributed descriptive literature and equipment specifications on the items of equipment submitted at least 30 days prior to the Invitation for Bid.
2. Specifications of equipment as set forth in this document are minimum requirements, unless otherwise stated, and shall not be construed as limiting the overall quality, quantity, or performance characteristics of items furnished in the System. When the Contractor furnishes an item of equipment for which there is a specification contained herein, the item of equipment shall meet or exceed the specification for that item of equipment.

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3. The Contractor shall provide written verification, in writing to the RE at time of installation, that the type of wire/cable being provided is recommended and approved by the OEM. The Contractor is responsible for providing the proper size and type of cable duct and/or conduit and wiring even though the actual installation may be by another subcontractor.
4. Active electronic component equipment shall consist of solid state components, be rated for continuous duty service, comply with the requirements of FCC standards for telephone equipment, systems, and service.
5. All passive distribution equipment shall meet or exceed -80 dB radiation shielding specifications.
6. All interconnecting twisted pair, fiber-optic or coaxial cables shall be terminated on equipment terminal boards, punch blocks, breakout boxes, splice blocks, and unused equipment ports/taps shall be terminated according to the OEM's instructions for telephone cable systems without adapters. The Contractor shall not leave unused or spare twisted pair wire, fiber-optic, or coaxial cable unterminated, unconnected, loose or unsecured.
7. Color code all distribution wiring to conform to the Telephone Industry standard, EIA/TIA, and this document, which ever is the more stringent. At a minimum, all equipment, cable duct and/or conduit, enclosures, wiring, terminals, and cables shall be clearly and permanently labeled according to and using the provided record drawings, to facilitate installation and maintenance. Reference Specification Section 27 10 00, STRUCTURED CABLING and Section 27 31 00, VOICE COMMUNICATIONS SWITCHING AND ROUTING EQUIPMENT.
8. Connect the System's primary input AC power to the Facility's Critical Branch of the Emergency AC power distribution system as shown on the plans or if not shown on the plans consult with RE regarding a suitable circuit location prior to bidding.
9. Plug-in connectors shall be provided to connect all equipment, except coaxial cables and interface points. Coaxial cable distribution points and RF transmission lines shall use coaxial cable connections recommended by the cable OEM and approved by the System OEM. Base- band cable systems shall utilize barrier terminal screw type connectors, at a minimum. Crimp type connectors installed



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with a ratchet type installation tool are and acceptable alternate as long as the cable dress, pairs, shielding, grounding, and connections and labeling are provided the same as the barrier terminal strip connectors. Tape of any type, wire nuts, or solder type connections are unacceptable and will not be approved.

10. All equipment faceplates utilized in the System shall be stainless steel, anodized aluminum, or UL approved cyclac plastic for the areas where provided.
11. Noise filters and surge protectors shall be provided for each equipment interface cabinet, switch equipment cabinet, control console, local, and remote active equipment locations to ensure protection from input primary AC power surges and noise glitches are not induced into low Voltage data circuits.

**D. Equipment Functional Characteristics:**

<b>FUNCTIONS</b>	<b>CHARACTERISTICS</b>
Input Voltage	105 to 130 VAC
POWER LINE FREQUENCY	60 HZ $\pm 2.0$ HZ
Operating Temperature	0 to 50 degrees (°) Centigrade (C)
Humidity	80 percent (%) minimum rating

**E. Equipment Standards and Testing:**

1. The System has been defined herein as connected to systems identified as Critical Care performing Life Support Functions. Therefore, at a minimum, the system shall conform to all aforementioned National and/or Local Life Safety Codes (which ever are the more stringent), NFPA, NEC, this specification, JCAHCO Life Safety Accreditation requirements, and the OEM recommendations, instructions, and guidelines.
2. All supplies and materials shall be listed, labeled or certified by UL or a nationally recognized testing laboratory where such standards have been established for the supplies, materials or equipment. See paragraph minimum requirements Section 27 05 11, REQUIREMENTS FOR COMMUNICATIONS INSTALLATIONS, and the guidelines listed in paragraph 2.J.2.
3. The provided active and passive equipment required by the System design and approved technical submittal must conform with each UL standard in effect for the equipment, as of the date of the

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technical submittal (or the date when the RE approved system equipment necessary to be replaced) was technically reviewed and approved by VA. Where a UL standard is in existence for equipment to be used in completion of this contract, the equipment must bear the approved UL seal.

4. Each item of electronic equipment to be provided under this contract must bear the approved UL seal or the seal of the testing laboratory that warrants the equipment has been tested in accordance with, and conforms to the specified standards.

**2.2 DISTRIBUTION EQUIPMENT AND SYSTEMS**

**A. Telecommunication Outlet (TCO):**

1. The TCO shall consist of two telephone multipin jack and three data multipin jacks mounted in a steel outlet box. A separate 100mm (4in.) x 100mm (4in.) x 63mm (2.5in.) steel outlet box with a labeled stainless steel faceplate will be used. A second 100mm (4in.) x 100mm (4in.) x 63mm (2.5in.) steel outlet box with a labeled faceplate shall be provided as required adjacent to the first box to ensure system connections and expandability requirements are met.
2. All telephone multipin connections shall be RJ-45/11 compatible female types. All data multipin connections shall be RJ-45 female types. 3. The TCO shall be fed from the appropriate CCS located in the respective RTC in a manner to provide a uniform and balanced distribution system.
3. Interface of the data multipin jacks to appropriate patch panels (or approved "punch down" blocks) in the associated RTC, is the responsibility of the Contractor. The Contractor shall not extend data cables from the RTCs to data terminal equipment or install data terminal equipment.
4. The wall outlet shall be provided with a stainless steel or approve alternate cover plate to fit the telephone multipin jack, data multi-pin jacks and the outlet box provided (100mm (4in.) x 100mm (4in.) for single and 100mm (4in.) x 200mm (8in.) for dual outlet box applications). For PBPV installations, the cover plate shall be stainless steel.
5. Interface of the analog RF "F", to appropriate patch panels in the associated RTC, is the responsibility of the Contractor. The

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Contractor shall not cross-connect analog cables in the RTCs to analog equipment or install active analog equipment.

- B. Distribution Cables: Each cable shall meet or exceed the following specifications for the specific type of cable. Each cable reel shall be sweep tested and certified by the OEM by tags affixed to each reel. The Contractor shall turn over all sweep tags to the RE or PM. Additionally, the Contractor shall provide a 610 mm (2 ft.) sample of each provided cable, to the RE and receive approval before installation. Cables installed in any outside location (i.e. above ground, under ground in conduit, ducts, pathways, etc.) shall be filled with a waterproofing compound between outside jacket (not immediately touching any provided armor) and inter conductors to seal punctures in the jacket and protect the conductors from moisture.

1. Remote Control:

- a. The remote control cable shall be multi-conductor with stranded (solid is permissible) conductors. The cable shall be able to handle the power and voltage necessary to control specified system equipment from a remote location. The cable shall be UL listed and pass the FR-1 vertical flame test, at a minimum. Each conductor shall be color-coded. Combined multi-conductor and coaxial cables are acceptable for this installation, as long as all system performance standards are met.

b. Technical Characteristics:

Length	As required, in 1K (3,000 ft.) reels minimum
Connectors	As required by system design
Size	18 AWG, minimum, Outside 20 AWG, minimum, Inside
Color coding	Required, EIA industry standard
Bend radius	10X the cable outside diameter
Impedance	As required
Shield coverage	As required by OEM specification
Attenuation	
Frequency in mHz	dB per 305 M (1,000ft.), maximum
0.7	5.2
1.0	6.5
4.0	14.0

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8.0	19.0
16.0	26.0
20.0	29.0
25.0	33.0
31.0	36.0
50.0	52.0

2. Telephone:

- a. The System cable shall be provided by the Contractor to meet the minimum system requirements of Category Six service. The cable shall interconnect each part of the system. The cable shall be completely survivable in areas where it is installed.

b. Technical Characteristics:

Length	As required, in 1K (3,000 ft.) reels minimum
Cable	Voice grade category six
Connectors	As required by system design
Size	22 AWG, minimum, Outside 24 AWG, minimum, Inside
Color coding	Required, telephone industry standard
Bend radius	10X the cable outside diameter
Impedance	120 Ohms $\pm$ 15%, BAL
Shield coverage	As required by OEM specification
Attenuation	
Frequency in mHz	dB per 305 M (1,000ft.), maximum
0.7	5.2
1.0	6.5
4.0	14.0
8.0	19.0
16.0	26.0
20.0	29.0
25.0	33.0
31.0	36.0
62.0	52.0
100.0	68.0

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3. Data Multi-Conductor:

- a. The cable shall be multi-conductor, shielded or unshielded cable with stranded conductors. The cable shall be able to handle the power and voltage used over the distance required. It shall meet Category Six service at a minimum.

b. Technical Characteristics:

Wire size	22 AWG, minimum
Working shield	350 V
Bend radius	10X the cable outside diameter
Impedance	100 Ohms $\pm$ 15%, BAL
Bandwidth	100 mHz, minimum
DC RESISTANCE	10.0 Ohms/100M, maximum
Shield coverage	
Overall Outside (if OEM specified)	100%
Individual Pairs (if OEM specified)	100%
Attenuation	
Frequency in mHz	dB per 305 M (1,000ft.), maximum
0.7	5.2
1.0	6.5
4.0	14.0
8.0	19.0
16.0	26.0
20.0	29.0
25.0	33.0
31.0	36.0
62.0	52.0
100.0	68.0

4. Fiber Optic:

a. Multimode Fiber:

- 1) The general purpose multimode fiber optic cable shall be a dual window type installed in conduit for all system locations. A load-bearing support braid shall surround the inner tube for strength during cable installation.

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2) Technical Characteristics:

Bend radius	6.0", minimum Outer jacket, As required
FIBER DIAMETER	62.5 MICRONS
Cladding	125 microns
Attenuation	
850 nM	4.0 dB per kM, maximum
1,300 nM	2.0 dB per kM, maximum
Bandwidth	
850 nM	160 mHz, minimum
1,300 nM	500 mHz, minimum
Connectors	Stainless steel

b. Single mode Fiber:

- 1) The general purpose single mode fiber optic cable shall be a dual window type installed in conduit for all system locations. A load-bearing support braid shall surround the inner tube for strength during cable installation.

2) Technical Characteristics:

Bend radius	100 mm (4 in.) minimum
Outer jacket	PVC
Fiber diameter	8.7 microns
Cladding	125 microns
Attenuation at 850 nM	1.0 dBm per km
Connectors	Stainless Steel

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5. AC Power Cable: AC power cable(s) shall be 3-conductor, no. 12 AWG minimum, and rated for 13A-125V and 1,625W. Master AC power, installation specification and requirements, are given in the NEC and herein.

6. General Purpose Analog RF:

a. The coaxial cable shall be an RG-6/U type (or equal), minimum and shall be increased in size (i.e. RG-11/U, .500", .750", etc.) as required to meet system design. It may also be used for baseband signals as approved by the OEM.

b. Technical Characteristics:

Impedance	75 OHM, UNBAL
Center conductor	20 AWG, solid or stranded copper, or copper plated steel or aluminum
Dielectric	Cellular polyethylene
Shield coverage	95%, copper braid
Connector type	BNC or UHF
Attenuation	
Frequency (k or mHz)	Maximum dB/30.5M (100ft.)
10 kHz	0.20
100 kHz	0.22
1.0 kHz	0.25
4.5 mHz	0.85
10.0 mHz	1.40
100 mHz	5.00

7. Public Address and/or General Purpose Audio:

a. The audio cable shall be two-conductor, STP cable with stranded conductors. The cable shall be able to handle the power used for the load impedance over the distance required, with not more than 5% power loss. This cable is to be provided in local PA areas only and is not to be used as a part of the telephone system.

b. Technical Characteristics:

Impedance	70.7VRMS audio signal
Wire size	20 AWG, minimum
Working shield	350 V
Color coding	Required, EIA audio industry standard

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Connectors	As required
Bend radius	10X the cable outside diameter
Impedance	100 Ohms $\pm$ 15%, BAL
Bandwidth	20 mHz, minimum
DC resistance	10.0 Ohms/100M (330 ft.), maximum
Shield coverage	
Overall Outside (if OEM specified)	100%
Individual Pairs (if OEM specified)	100%
Attenuation	
Frequency in mHz	dB per 305 M (1,000ft.), maximum
0.7	5.2
1.0	6.5
4.0	14.0
8.0	19.0
16.0	26.0
20.0	29.0

8. General Purpose Analog Video:

- a. The coaxial cable shall be an RG-59/U type (or equal), minimum.  
It may also be used for baseband signals as approved by the OEM.
- b. Technical Characteristics:

Impedance	75 Ohm, UNBAL
Center conductor	20 AWG, SOLID OR STRANDED COPPER
Dielectric	Cellular polyethylene
Shield coverage	95%, copper braid
Connector type	BNC or UHF
Attenuation	
Frequency (k or mHz)	Maximum dB/30.5M (100ft.)
10 kHz	0.20
100 kHz	0.22
1.0 kHz	0.25
4.5 mHz	0.85
10.0 mHz	1.40
100 mHz	5.00



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C. Outlet Connection Cables:

1. Telephone:

- a. The Contractor shall provide a connection cable for each TCO telephone jack in the System with 10% spares. The telephone connection cable shall connect the telephone instrument to the TCO telephone jack. The Contractor shall not provide telephone instrument(s) or equipment.

b. Technical Characteristics:

Length	1.8M (6ft.), minimum
Cable	Voice Grade
Connector	RJ-11/45 compatible male on each end
Size	24 AWG, minimum
Color coding	Required, telephone industry standard

2. Data:

- a. The Contractor shall provide a connection cable for each TCO data jack in the system with 10% spares. The data connection cable shall connect a data instrument to the TCO data jack. The Contractor shall not provide data terminal(s)/equipment.

b. Technical Characteristics:

Length	1.8M (6 ft.), minimum
Cable	Data grade Category Six
Connector	RJ-45 male on each end
Color coding	Required, data industry standard
Size	24 AWG, minimum

3. Fiber Optic:

- a. The Contractor shall provide a connection cable for each TCO fiber optic connector in the System with 10% spares. The data connection cable shall connect a fiber optic instrument to the TCO fiber optic jack. The Contractor shall not provide fiber optic instrument(s)/equipment.

b. Technical Characteristics:

Length	1.8M (6 ft.), minimum
Cable	Flexible single conductor with jacket

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Connector	ST male on each end
Size	To fit single mode or multimode cable

4. Analog RF:

- a. The Contractor shall provide a connection cable for each TCO analog RF connector in the System with 10% spares. The analog RF connection cable shall connect a analog RF instrument to the TCO analog RF jack. The Contractor shall not provide analog RF equipment.

b. Technical Characteristics:

Length	1.8M (6 ft.), minimum
Cable	Flexible RG-6/U, minimum
Connector	"F" male on each end

5. Analog Video:

- a. The Contractor shall provide a connection cable for each TCO analog video jack in the System with 10% spares. The analog video connection cable shall connect a analog video instrument to the TCO analog video jack. The Contractor shall not provide analog video instrument(s)/equipment.

b. Technical Characteristics:

Length	1.8M (6 ft.), minimum
Cable	Flexible RG-59/U, minimum
Connector	BNC male on each end

D. System Connectors:

1. Solderless (Forked Connector):

- a. The connector shall have a crimp-on coupling for quick connect/disconnect of wires or cables. The crimp-on connector shall be designed to fit the wire or cable furnished. The connector barrel shall be insulated and color-coded.

b. Technical Characteristics:

Impedance	As required
Working Voltage	500 V

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2. Multipin:

- a. The connector shall have a crimp-on coupling for quick connect/disconnect of wires or cables. The crimp-on connector shall be designed to fit the wire or cable furnished. The connector housing shall be fully enclosed and shielded. It shall be secured to the cable group by screw type compression sleeves.

b. Technical Characteristics:

Impedance	As required
Working Voltage	500 V
Number of pins	As requires, usually 25 pairs minimum

3. Modular (RJ-45/11 and RJ-45): The connectors shall be commercial types for voice and high speed data transmission applications. he connector shall be compatible with telephone instruments, computer terminals, and other type devices requiring linking through the modular telecommunications outlet to the System. The connector shall be compatible with UTP and STP cables.

a. Technical Characteristics:

Type	Number of Pins
RJ-11/45	Compatible with RJ45
RJ-45	Eight
Dielectric	Surge
Voltage	1,000V RMS, 60 Hz @ one minute, minimum
Current	2.2A RMS @ 30 Minutes or 7.0A RMS @ 5.0 seconds
Leakage	100 $\mu$ A, maximum
Connectability	
Initial contact resistance	20 mili-Ohms, maximum
Insulation displacement	10 mili-Ohms, maximum
Interface	Must interface with modular jacks from a variety of OEMs. RJ-11/45 plugs shall provide connection when used in RJ-45 jacks.
Durability	200 insertions/withdrawals, minimum

4. Fiber Optic: The connectors shall be commercial types for voice and high speed data transmission applications. The connector shall be

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compatible with telephone instruments, computer terminals, and other type devices requiring linking through the modular telecommunications outlet to the system. The connector shall be compatible with UTP and STP cables.

5. "F" Type:

a. The "F" connector shall have a screw type coupling for quick connect/disconnect of coaxial cable/termination's. It shall be a crimp-on connector designed to fit the coaxial cable furnished with integral 12.7 mm (½in.) ferrule.

b. Technical Characteristics:

Impedance	75 Ohms, UNBAL
Working Voltage	500 V

E. Terminators:

1. Coaxial:

a. These units shall be metal-housed precision types in the frequency ranges selected. They shall be the screw-on type that has low VSWR when installed and the proper impedance to terminate the required system unit or coaxial cable.

b. Technical Characteristics:

Frequency	0-1 GHz
Power blocking	As required
Return loss	25 dB
Connectors	"F", "BNC", minimum
Impedance	50 or 75 Ohms, UNBAL

2. Fiber Optic:

a. These units shall be metal-housed precision types in the frequency ranges selected. They shall be the screw-on type that has low VSWR when installed and the proper impedance to terminate the required system unit or fiber optic cable.

b. Technical Characteristics:

Frequency	Lightwave
Power blocking	As required
Return loss	25 dB
Connectors	"ST", minimum

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Construction	Stainless steel
Impedance	As required

**F. Distribution Frames:**

1. A new stand-alone (i.e., self supporting, free standing) MDF shall be provided to interconnect the EPBX and computer room. The MDF shall be modular and equipped with modular terminating mini blocks (i.e. Ericsson, 3M, etc.), and patch panels that are as small as possible and provide all the requirements of this specifications as described herein.
2. All cable distribution closets and MDFs shall be wired in accordance with industry standards and shall employ "latest state-of-the-art" modular cross-connect devices. The MDF/telephone closet riser cable shall be sized to satisfy all voice requirements plus not less than 50% spare (growth) capacity in each telephone closet which includes a fiber optic backbone. The MDF/telephone closet riser cable shall be sized to satisfy all voice and data requirements plus not less than 50% spare (growth) capacity in each telephone closet which does not include a fiber optic backbone.
3. The MDF and all intermediate distribution frames shall be connected to the EPBX system ground.
4. Technical Characteristics:

Telephone	
IDC type unit	As described in Part 2
Contact wires	50 micron of Gold over Nickel
Contact pressure	100 Grams, MIN
110A Punch blocks	Acceptable alternate to IDC
Data	110A blocks as described in Part 2
Fiber optic	Patch panel as described in Part 2
Analog Video	Patch panel as described in Part 2

**2.3 TELECOMMUNICATIONS CLOSET REQUIREMENTS**

- A. Refer to VA Handbook H-088C3, Telephone System Requirements, for specific TC guidelines for size, power input, security, and backboard mounting requirements. It is the Contractors responsibility to ensure TC compliance with the System Requirements.

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**2.4 ENVIRONMENTAL REQUIREMENTS**

Technical submittals shall identify the environmental specifications for housing the system. These environmental specifications shall identify the requirements for initial and expanded system configurations for:

- A. Floor loading for batteries and cabinets.
- B. Minimum floor space and ceiling heights.
- C. Minimum size of doors for equipment passage.
- D. Power requirements: The bidders shall provide the specific voltage, amperage, phases, and quantities of circuits required.
- E. Air conditioning, heating, and humidity requirements. The bidder shall identify the ambient temperature and relative humidity operating ranges required preventing equipment damage.
- F. Air conditioning requirements (expressed in BTU per hour, based on adequate dissipation of generated heat to maintain required room and equipment standards).
- G. Proposed floor plan based on the expanded system configuration of the bidder's proposed EPBX for this Facility.
- H. Conduit size requirement (between equipment room and console room).

**2.5 INSTALLATION KIT**

The kit shall be provided that, at a minimum, includes all connectors and terminals, labeling systems, audio spade lugs, barrier strips, punch blocks or wire wrap terminals, heat shrink tubing, cable ties, solder, hangers, clamps, bolts, conduit, cable duct, and/or cable tray, etc., required to accomplish a neat and secure installation. All wires shall terminate in a spade lug and barrier strip, wire wrap terminal or punch block. Unfinished or unlabeled wire connections shall not be allowed. Turn over to the RE all unused and partially opened installation kit boxes, coaxial, fiberoptic, and twisted pair cable reels, conduit, cable tray, and/or cable duct bundles, wire rolls, physical installation hardware. The following are the minimum required installation sub-kits:

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A. System Grounding:

1. The grounding kit shall include all cable and installation hardware required. All radio equipment shall be connected to earth ground via internal building wiring, according to the NEC.
2. This includes, but is not limited to:
  - a. Coaxial Cable Shields.
  - b. Control Cable Shields.
  - c. Data Cable Shields.
  - d. Equipment Racks.
  - e. Equipment Cabinets.
  - f. Conduits.
  - g. Duct.
  - h. Cable Trays.
  - i. Power Panels.
  - j. Connector Panels.
  - k. Grounding Blocks.

B. Coaxial Cable: The coaxial cable kit shall include all coaxial connectors, cable tying straps, heat shrink tabbing, hangers, clamps, etc., required to accomplish a neat and secure installation.

C. Wire and Cable: The wire and cable kit shall include all connectors and terminals, audio spade lugs, barrier straps, punch blocks, wire wrap strips, heat shrink tubing, tie wraps, solder, hangers, clamps, labels etc., required to accomplish a neat and orderly installation.

D. Conduit, Cable Duct, and Cable Tray: The kit shall include all conduit, duct, trays, junction boxes, back boxes, cover plates, feed through nipples, hangers, clamps, other hardware required to accomplish a neat and secure conduit, cable duct, and/or cable tray installation in accordance with the NEC and this document.

E. Equipment Interface: The equipment kit shall include any item or quantity of equipment, cable, mounting hardware and materials needed to interface the systems with the identified sub-system(s) according to the OEM requirements and this document.

F. Labels: The labeling kit shall include any item or quantity of labels, tools, stencils, and materials needed to completely and correctly label each subsystem according to the OEM requirements, as-installed drawings, and this document.

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- G. Documentation: The documentation kit shall include any item or quantity of items, computer discs, as installed drawings, equipment, maintenance, and operation manuals, and OEM materials needed to completely and correctly provide the system documentation as required by this document and explained herein.

**PART 3 - EXECUTION**

**3.1 INSTALLATION**

A. Product Delivery, Storage and Handling:

1. Delivery: Deliver materials to the job site in OEM's original unopened containers, clearly labeled with the OEM's name and equipment catalog numbers, model and serial identification numbers. The RE may inventory the cable, patch panels, and related equipment.
2. Storage and Handling: Store and protect equipment in a manner, which will preclude damage as directed by the RE.

B. System Installation:

1. After the contract's been awarded, and within the time period specified in the contract, the Contractor shall deliver the total system in a manner that fully complies with the requirements of this specification. The Contractor shall make no substitutions or changes in the System without written approval from the RE and PM.
2. The Contractor shall install all equipment and systems in a manner that complies with accepted industry standards of good practice, OEM instructions, the requirements of this specification, and in a manner which does not constitute a safety hazard. The Contractor shall insure that all installation personnel understands and complies with all the requirements of this specification.
3. The Contractor shall install suitable filters, traps, directional couplers, splitters, TC's, and pads for minimizing interference and for balancing the System. Items used for balancing and minimizing interference shall be able to pass telephone and data , and lightwave, and analog signals in the frequency bands selected, in the direction specified, with low loss, and high isolation, and with minimal delay of specified frequencies and signals. The Contractor shall provide all equipment necessary to meet the requirements of Paragraph 2.1.C and the System performance standards.
4. All passive equipment shall be connected according to the OEM's specifications to insure future correct termination, isolation,



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impedance match, and signal level balance at each telephone/data outlet.

5. Where TCOs are installed adjacent to each other, install one outlet for each instrument.
6. All lines shall be terminated in a suitable manner to facilitate future expansion of the System. There shall be a minimum of one spare 25 pair cable at each distribution point on each floor.
7. All vertical and horizontal copper and fiber optic, and coaxial cables shall be terminated so any future changes only requires modifications of the existing or signal closet equipment only.
8. Terminating resistors or devices shall be used to terminate all unused branches, outlets, equipment ports of the System, and shall be devices designed for the purpose of terminating fiber optic or twisted pair, and coaxial, and lightwave cables carrying telephone and data, and analog signals in telephone and data , and analog video , and lightwave systems.
9. Equipment installed outdoors shall be weatherproof or installed in weatherproof enclosures with hinged doors and locks with two keys.
10. Equipment installed indoors shall be installed in metal cabinets with hinged doors and locks with two keys.

**C. Conduit and Signal Ducts:**

**1. Conduit:**

- a. The Contractor shall employ the latest installation practices and materials. The Contractor shall provide conduit, junction boxes, connectors, sleeves, weatherheads, pitch pockets, and associated sealing materials not specifically identified in this document as GFE. Conduit penetrations of walls, ceilings, floors, interstitial space, fire barriers, etc., shall be sleeved and sealed. The minimum conduit size shall be 19 mm (3/4 in.).
- b. All cables shall be installed in separate conduit and/or signal ducts (exception from the separate conduit requirement to allow telephone cables to be installed in partitioned cable tray with data cables may be granted in writing by the RE if requested.) Conduits shall be provided in accordance with Section 27 05 33, RACEWAYS AND BOXES FOR COMMUNICATIONS SYSTEMS, and NEC Articles 517 for Critical Care and 800 for Communications systems, at a minimum.

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- c. When metal, plastic covered, etc., flexible cable protective armor or systems are specifically authorized to be provided for use in the System, their installation guidelines and standards shall be as specified herein, Section 27 05 33, RACEWAYS AND BOXES FOR COMMUNICATIONS SYSTEMS, and the NEC.
  - d. When "innerduct" flexible cable protective systems is specifically authorized to be provided for use in the System, it's installation guidelines and standards shall be as the specified herein, Section 27 05 33, RACEWAYS AND BOXES FOR COMMUNICATIONS SYSTEMS, and the NEC.
  - e. Conduit (including GFE) fill shall not exceed 40%. Each conduit end shall be equipped with a protective insulator or sleeve to cover the conduit end, connection nut or clamp, to protect the wire or cable during installation and remaining in the conduit. Electrical power conduit shall be installed in accordance with the NEC. AC power conduit shall be run separate from signal conduit.
  - f. When metal, plastic covered, etc., flexible cable protective armor or systems are specifically authorized to be provided for use in the System, their installation guidelines and standards shall be as specified herein, Section 27 05 33, RACEWAYS AND BOXES FOR COMMUNICATIONS SYSTEMS, and the NEC.
  - g. Ensure that Critical Care ----- Nurse Call, and PA Systems (as identified by NEC Section 517) are completely separated and protected from all other systems.
2. Signal Duct, Cable Duct, or Cable Tray:
- a. The Contractor shall use existing signal duct, cable duct, and/or cable tray, when identified and approved by the RE.
  - b. Approved signal and/or cable duct shall be a minimum size of 100 mm x 100 mm (4 in. X 4 in.) inside diameter with removable tops or sides, as appropriate. Protective sleeves, guides or barriers are required on all sharp corners, openings, anchors, bolts or screw ends, junction, interface and connection points.
  - c. Approved cable tray shall be fully covered, mechanically and physically partitioned for multiple electronic circuit use, and be UL certified and labeled for use with telecommunication

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circuits and/or systems. The RE shall approve width and height dimensions.

**D. Distribution System Signal Wires and Cables:**

1. Wires and cables shall be provided in the same manner and use like construction practices as Fire Protective and other Emergency Systems that are identified and outlined in NFPA 101, Life Safety Code, Chapters 7, 12, and/or 13, NFPA 70, National Electrical Code, Chapter 7, Special Conditions. The wires and cables shall be able to withstand adverse environmental conditions in their respective location without deterioration. Wires and cables shall enter each equipment enclosure, console, cabinet or rack in such a manner that all doors or access panels can be opened and closed without removal or disruption of the cables.
  - a. Each wire and cable shall terminate on an item of equipment by direct connection. Spare or unused wire and cable shall be provided with appropriate connectors (female types) that are installed in appropriate punch blocks, barrier strips, patch, or bulkhead connector panels.
  - b. Fiber optic cables that are spare, unused or dark shall be provided with Industry Standard "ST" type female connectors installed in appropriate break out, patch, or bulkhead connector panels provided in enclosure(s) and shall be protected from the environment.
  - c. Coaxial cables that are spare, unused or dark shall be provided with the cable OEM specified type female connectors installed in appropriate break out, patch, or bulkhead connector panels provided in enclosure(s) and shall be protected from the environment.
  - d. All cable junctions and taps shall be accessible. Provide an 8" X 8" X 4" (minimum) junction box attached to the cable duct or raceway for installation of distribution system passive equipment. Ensure all equipment and tap junctions are accessible.
2. Routing and Interconnection:
  - a. Wires or cables between consoles, cabinets, racks and other equipment shall be in an approved conduit, signal duct, cable duct, or cable tray that is secured to building structure.

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- b. Wires and cables shall be insulated to prevent contact with signal or current carrying conductors. Wires or cables used in assembling consoles, panels, equipment cabinets and racks shall be formed into harnesses that are bundled and tied. Harnessed wires or cables shall be combed straight, formed and dressed in either a vertical or horizontal relationship to equipment, controls, components or terminations.
- c. Harnesses with intertwined members are not acceptable. Each wire or cable that breaks out from a harness for connection or termination shall have been tied off at that harness or bundle point, and be provided with a neatly formed service loop.
- d. Wires and cables shall be grouped according to service (i.e.: AC, grounds, signal, DC, control, etc.). DC, control and signal cables may be included with any group. Wires and cables shall be neatly formed and shall not change position in the group throughout the conduit run. Wires and cables in approved signal duct, conduit, cable ducts, or cable trays shall be neatly formed, bundled, tied off in 600 mm to 900 mm (24 in. to 36 in.) lengths and shall not change position in the group throughout the run. Concealed splices are not allowed.
- e. Separate, organize, bundle, and route wires or cables to restrict EMI, channel crosstalk, or feedback oscillation inside any enclosure. Looking at any enclosure from the rear (wall mounted enclosures, junction, pull or interface boxes from the front), locate AC power, DC and speaker wires or cables on the left; coaxial, control, microphone and line level audio and data wires or cables, on the right. This installation shall be accomplished with ties and/or fasteners that will not damage or distort the wires or cables. Limit spacing between tied off points to a maximum of 150 mm (6 inches).
- f. Do not pull wire or cable through any box, fitting or enclosure where change of cable tray or signal or cable duct alignment or direction occurs. Ensure the proper bend radius is maintained for each wire or cable as specified by its OEM.
- g. Employ temporary guides, sheaves, rollers, and other necessary items to protect the wire or cable from excess tension or damage from bending during installation. Abrasion to wire or cable

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jackets is not acceptable and will not be allowed. Replace all cables whose jacket has been abraded. The discovery of any abraded and/or damaged cables during the proof of performance test shall be grounds for declaring the entire system unacceptable and the termination of the proof of performance test. Completely cover edges of wire or cable passing through holes in chassis, cabinets or racks, enclosures, pull or junction boxes, conduit, etc., with plastic or nylon grommeting.

- h. Cable runs shall be splice free between conduit junction and interface boxes and equipment locations.
- i. Cables shall be installed and fastened without causing sharp bends or rubbing of the cables against sharp edges. Cables shall be fastened with hardware that will not damage or distort them.
- j. Cables shall be labeled with permanent markers at the terminals of the electronic and passive equipment and at each junction point in the System. The lettering on the cables shall correspond with the lettering on the record diagrams.
- k. Completely test all of the cables after installation and replace any defective cables.
- l. Wires or cables that are installed outside of buildings shall be in conduit, secured to solid building structures. If specifically approved, on a case by case basis, to be run outside of conduit, the wires or cables shall be installed, as described herein. The bundled wires or cables must: Be tied at not less than 460 mm (18 in.) intervals to a solid building structure; have ultra violet protection and be totally waterproof (including all connections). The laying of wires or cables directly on roof tops, ladders, drooping down walls, walkways, floors, etc. is not allowed and will not be approved.
- m. Wires or cables installed outside of conduit, cable trays, wireways, cable duct, etc.
  - 1) Only when specifically authorized as described herein, will wires or cables be identified and approved to be installed outside of conduit. The wire or cable runs shall be UL rated plenum and OEM certified for use in air plenums.

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- 2) Wires and cables shall be hidden, protected, fastened and tied at 600 mm (24 in.) intervals, maximum, as described herein to building structure.
  - 3) Closer wire or cable fastening intervals may be required to prevent sagging, maintain clearance above suspended ceilings, remove unsightly wiring and cabling from view and discourage tampering and vandalism. Wire or cable runs, not provided in conduit, that penetrate outside building walls, supporting walls, and two hour fire barriers shall be sleeved and sealed with an approved fire retardant sealant.
  - 4) Wire or cable runs to system components installed in walls (i.e.: volume attenuators, circuit controllers, signal, or data outlets, etc.) may, when specifically authorized by the RE, be fished through hollow spaces in walls and shall be certified for use in air plenum areas.
- n. Wires or cables installed in underground conduit, duct, etc.
- 1) Wires or cables installed in underground installations shall be waterproofed by the inclusion of a water protective barrier (i.e. gel, magma, etc.) or flooding compound between the outside jacket and first shield. Each underground connection shall be accessible in a manhole, recessed ground level junction box, above ground pedestal, etc., and shall be provided with appropriate waterproof connectors to match the cable being installed. Once the System has been tested and found to meet the System performance standards and accepted by VA, the Contractor shall provide waterproof shrink tubing or approved mastic to fully encompass each wire or cable connection and overlay at least 150 mm (6 inches) above each wire or cable jacket trim point.
  - 2) It is not acceptable to connect waterproofed cable directly to an inside CCS punch block or directly to an equipment connection port. When an under ground cable enters a building, it shall be routed directly to the closest TC that has been designated as the building's IMTC. The Contractor shall provide a "transition" splice in this TC where the "water proofed" cable enters on one side and "dry" cable exits on the other side. The "transition" splice shall be fully waterproof

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and be capable of reentry for system servicing. Additionally, the transition splice shall not allow the waterproofing compound to migrate from the water proof cable to the dry cable.

- 3) Warning tape shall be continuously placed 300 mm (12 inches) above buried conduit, cable, etc.

**E. Outlet Boxes, Back Boxes, and Faceplates:**

1. Outlet Boxes: Signal, power, interface, connection, distribution, and junction boxes shall be provided as required by the system design, on-site inspection, and review of the contract drawings.
2. Back Boxes: Back boxes shall be provided as directed by the OEM as required by the approved system design, on-site inspection, and review of the contract drawings.
3. Face Plates (or Cover Plates): Faceplates shall be of a standard type, stainless steel, anodized aluminum or UL approved cyclac plastic construction and provided by the Contractor for each identified system outlet location. Connectors and jacks appearing on the faceplate shall be clearly and permanently marked.

**F. Connectors: Circuits, transmission lines, and signal extensions shall have continuity, correct connection and polarity. A uniform polarity shall be maintained between all points in the system.**

**1. Wires:**

- a. Wire ends shall be neatly formed and where insulation has been cut, heat shrink tubing shall be employed to secure the insulation on each wire. Tape of any type is not acceptable.
  - b. Audio spade lugs shall be installed on each wire (including spare or unused) end and connect to screw terminals of appropriate size barrier strips. AC barrier strips shall be provided with a protective cover to prevent accidental contact with wires carrying live AC current. Punch blocks are approved for signal, not AC wires. Wire Nut or "Scotch Lock" connectors are not acceptable for signal wire installation.
2. Cables: Each connector shall be designed for the specific size cable being used and installed with the OEM's approved installation tool. Typical system cable connectors include; but, are not limited to: Audio spade lug, punch block, wirewrap, etc.

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3. Speaker Line Audio:

- a. Each connector shall be installed according to the cable, transformer or speaker OEM instructions and using the OEM's approved installation tool. The Contractor shall ensure each speaker is properly phased and connected in the same manner throughout the System using two conductor type wires.
- b. One of the conductors shall be color coded to aid in establishing speaker signal polarity. Each speaker line shall be permanently soldered or audio spade lug connected to each appropriate speaker or line matching transformer connection terminal. Speaker line connection to each audio amplifier shall use audio spade lugs, as described herein.

G. AC Power: AC power wiring shall be run separately from signal cable.

H. Grounding:

1. General: The Contractor shall ground all Contractor Installed Equipment and identified Government Furnished Equipment to eliminate all shock hazards and to minimize, to the maximum extent possible, all ground loops, common mode returns, noise pickup, crosstalk, etc. The total ground resistance shall be 0.1 Ohm or less.
  - a. The Contractor shall install lightning arrestors and grounding in accordance with the NFPA and this specification.
  - b. Under no conditions shall the AC neutral, either in a power panel or in a receptacle outlet, be used for system control, subcarrier or audio reference ground.
  - c. The use of conduit, signal duct or cable trays as system or electrical ground is not acceptable and will not be permitted. These items may be used only for the dissipation of internally generated static charges (not to be confused with externally generated lightning) that may applied or generated outside the mechanical and/or physical confines of the System to earth ground. The discovery of improper system grounding shall be grounds to declare the System unacceptable and the termination of all system acceptance testing.
2. Cabinet Buss: A common ground buss of at least #10 AWG solid copper wire shall extend throughout each equipment cabinet and be connected to the system ground. Provide a separate isolated ground connection



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from each equipment cabinet ground buss to the system ground. Do not tie equipment ground busses together.

3. Equipment: Equipment shall be bonded to the cabinet bus with copper braid equivalent to at least #12 AWG. Self grounding equipment enclosures, racks or cabinets, that provide OEM certified functional ground connections through physical contact with installed equipment, are acceptable alternates.
  4. Cable Shields: Cable shields shall be bonded to the cabinet ground buss with #12 AWG minimum stranded copper wire at only one end of the cable run. Cable shields shall be insulated from each other, faceplates, equipment racks, consoles, enclosures or cabinets; except, at the system common ground point. Coaxial and audio cables, shall have one ground connection at the source; in all cases, cable shield ground connections shall be kept to a minimum.
- I. Labeling: Provide labeling in accordance with ANSI/EIA/TIA 606-A. All lettering for voice and data circuits shall be stenciled using thermal ink transfer process. Handwritten labels are not acceptable.
1. Cable and Wires (Hereinafter referred to as "Cable"): Cables shall be labeled at both ends in accordance with ANSI/EIA/TIA-606-B. Labels shall be permanent in contrasting colors. Cables shall be identified according to the System "Record Wiring Diagrams".
  2. Equipment: System equipment shall be permanently labeled with contrasting plastic laminate or bakelite material. System equipment shall be labeled on the face of the unit corresponding to its source.
  3. Conduit, Cable Duct, and/or Cable Tray: The Contractor shall label all conduit, duct and tray, including utilized GFE, with permanent marking devices or spray painted stenciling a minimum of 3 meters (10 ft.) identifying it as the System. In addition, each enclosure shall be labeled according to this standard.
  4. Termination Hardware: The Contractor shall label workstation outlets and patch panel connections using color coded labels with identifiers in accordance with ANSI/EIA/TIA-606-B and the "Record Wiring Diagrams".

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**3.2 TESTS**

**A. Interim Inspection:**

1. This inspection shall verify that the equipment provided adheres to the installation requirements of this document. The interim inspection will be conducted by a factory-certified representative and witnessed by a Government Representative. Each item of installed equipment shall be checked to insure appropriate UL certification markings. This inspection shall verify cabling terminations in telecommunications rooms and at workstations adhere to color code for T568A pin assignments and cabling connections are in compliance with ANSI/EIA/TIA standards. Visually confirm Category 6 marking of outlets, faceplates, outlet/connectors and patch cords.
2. Perform fiber optical field inspection tests via attenuation measurements on factory reels and provide results along with manufacturer certification for factory reel tests. Remove failed cable reels from project site upon attenuation test failure.
3. The Contractor shall notify the RE, in writing, of the estimated date the Contractor expects to be ready for the interim inspection, at least 20 working days before the requested inspection date.
4. Results of the interim inspection shall be provided to the RE and PM. If major or multiple deficiencies are discovered, a second interim inspection may be required before permitting the Contractor to continue with the system installation.
5. The RE and/or the PM shall determine if an additional inspection is required, or if the Contractor will be allowed to proceed with the installation. In either case, re-inspection of the deficiencies noted during the interim inspection(s), will be part of the proof of performance test. The interim inspection shall not affect the Systems' completion date. The Contracting Officer shall ensure all test documents will become a part of the Systems record documentation.

**B. Pretesting:**

1. Upon completing the installation of the System, the Contractor shall align and balance the system. The Contractor shall pretest the entire system.

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2. Pretesting Procedure:

- a. During the system pretest, the Contractor shall verify (utilizing the approved spectrum analyzer and test equipment) that the System is fully operational and meets all the system performance requirements of this standard.
  - b. The Contractor shall pretest and verify that all System functions and specification requirements are met and operational, no unwanted aural effects, such as signal distortion, noise pulses, glitches, audio hum, poling noise, etc. are present. The Contractor shall measure and record the aural carrier levels of each system telephone and data channel, at each of the following points in the system:
    - 1) MDF interfaces or inputs and outputs.
    - 2) Signal Level at each interface point to the distribution system, the last outlet on each trunk line plus all outlets installed as part of this contract.
  3. The Contractor shall provide four (4) copies of the recorded system pretest measurements and the written certification that the System is ready for the formal acceptance test shall be submitted to the RE.
- C. Acceptance Test: After the System has been pretested and the Contractor has submitted the pretest results and certification to the RE, then the Contractor shall schedule an acceptance test date and give the RE 30 days written notice prior to the date the acceptance test is expected to begin. The System shall be tested in the presence of a Government Representative and an OEM certified representative. The System shall be tested utilizing the approved test equipment to certify proof of performance and Life Safety compliance. The test shall verify that the total System meets the requirements of this specification. The notification of the acceptance test shall include the expected length (in time) of the test.
- D. Verification Tests:
1. Test the UTP backbone copper cabling for DC loop resistance, shorts, opens, intermittent faults, and polarity between conductors, and between conductors and shield, if cable has an overall shield. Test the operation of shorting bars in connection blocks. Test cables after termination and prior to cross-connection.

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2. Multimode Fiber Optic Cable: Perform end-to-end attenuation tests in accordance with ANSI/EIA/TIA-568-B.3 and ANSI/EIA/TIA-526-14A using Method A, Optical Power Meter and Light Source. Perform verification acceptance test.

3. Single mode Fiber Optic Cable: Perform end-to-end attenuation tests in accordance with ANSI/EIA/TIA-568-B.3 and ANSI/EIA/TIA-526-7 using Method A, Optical Power Meter and Light Source. Perform verification acceptance test.

**E. Performance Testing:**

1. Perform Category 6 tests in accordance with ANSI/EIA/TIA-568-B.1 and ANSI/EIA/TIA-568-B.2. Test shall include the following: wire map, length, insertion loss, return loss, NEXT, PSNEXT, ELFEXT, PSELFEXT, propagation delay and delay skew.

2. Fiber Optic Links: Perform end-to-end fiber optic cable link tests in accordance with ANSI/EIA/TIA-568-B.3.

**F. Total System Acceptance Test:** The Contractor shall perform verification tests for UTP copper cabling system(s) and the multimode and single mode fiber optic cabling system(s) after the complete telecommunication distribution system and workstation outlet are installed.

1. Voice Testing: Connect to the network interface device at the demarcation point. Go off-hook and receive dial tone from the LEC. If a test number is available, place and receive a local, long distance, and FTS telephone call.

2. Data Testing: Connect to the network interface device at the demarcation point. Log onto the network to ensure proper connection to the network is achieved.

**3.3 TRAINING**

A. Furnish the services of a factory-trained engineer or technician for a total of two four hour classes to instruct designated Facility IRM personnel. Instruction shall include cross connection, corrective, and preventive maintenance of the System and equipment.

B. Before the System can be accepted by the VA, this training must be accomplished. Training will be scheduled at the convenience of the Facilities Contracting Officer and Chief of Engineering Service.

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**3.4 WARRANTY**

A. Comply with FAR clause 52.246-21, except that warranty shall be as follows:

1. The Contractor shall warranty that all installed material and equipment will be free from defects, workmanship, and will remain so for a period of one year from date of final acceptance of the System by the VA. The Contractor shall provide OEM's equipment warranty documents, to the RE (or Facility Contracting Officer if the Facility has taken possession of the building(s)), that certifies each item of equipment installed conforms to OEM published specifications.
2. The Contractor's maintenance personnel shall have the ability to contact the Contractor and OEM for emergency maintenance and logistic assistance, remote diagnostic testing, and assistance in resolving technical problems at any time. The Contractor and OEM shall provide this contact capability at no additional cost to the VA.
3. All Contractor installation, maintenance, and supervisor personnel shall be fully qualified by the OEM and must provide two (2) copies of current and qualified OEM training certificates and OEM certification upon request.
4. Additionally, the Contractor shall accomplish the following minimum requirements during the one year warranty period:
  - a. Response Time:
    - 1) The RE (or facility Contracting Officer if the facility has taken possession of the building[s]) are the Contractor's reporting and contact officials for the System trouble calls, during the warranty period.
    - 2) A standard workweek is considered 8:00 A.M. to 5:00 P.M., Monday through Friday exclusive of Federal Holidays.
    - 3) The Contractor shall respond and correct on-site trouble calls, during the standard work week to:
      - a) A routine trouble call within one working days of its report. A routine trouble is considered a trouble which causes a system outlet, station, or patch cord to be inoperable.

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- b) An emergency trouble call within 6 hours of its report. An emergency trouble is considered a trouble which causes a subsystem or distribution point to be inoperable at anytime. Additionally, the loss of a minimum of 50 station or system lines shall be deemed as this type of a trouble call.
- 4) The Contractor shall respond on-site to a catastrophic trouble call within 4 hours of its report. A catastrophic trouble call is considered total system failure.
  - a) If a system failure cannot be corrected within four hours (exclusive of the standard work time limits), the Contractor shall be responsible for providing alternate system CSS or TCO equipment, or cables. The alternate equipment and/or cables shall be operational within four hours after the four hour trouble shooting time.
  - b) Routine or emergency trouble calls in critical emergency health care facilities (i.e., cardiac arrest, intensive care units, etc.) shall also be deemed as a catastrophic trouble call if so determined by the RE or Facility Director. The RE or Facility Contracting Officer shall notify the Contractor of this type of trouble call at the direction of the Facilities Director.
- b. Required on-site visits during the one year warranty period
  - 1) The Contractor shall visit, on-site, for a minimum of eight hours, once every 12 weeks, during the warranty period, to perform system preventive maintenance, equipment cleaning, and operational adjustments to maintain the System according the descriptions identified in this SPEC.
    - a) The Contractor shall arrange all Facility visits with the RE or Facility Contracting Officer prior to performing the required maintenance visits.
    - b) The Contractor in accordance with the OEM's recommended practice and service intervals shall perform preventive maintenance during a non-busy time agreed to by the RE or Facility Contracting Officer and the Contractor.

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- c) The preventive maintenance schedule, functions and reports shall be provided to and approved by the RE or Facility Contracting Officer.
  - 2) The Contractor shall provide the RE or Facility Contracting Officer a type written report itemizing each deficiency found and the corrective action performed during each required visit or official reported trouble call. The Contractor shall provide the RE with sample copies of these reports for review and approval at the beginning of the Total System Acceptance Test. The following reports are the minimum required:
    - a) Monthly Report: The Contractor shall provide a monthly summary all equipment and sub-systems serviced during this warranty period to RE or Facilities Contracting Officer by the fifth working day after the end of each month. The report shall clearly and concisely describe the services rendered, parts replaced and repairs performed. The report shall prescribe anticipated future needs of the equipment and Systems for preventive and predictive maintenance
    - b) Contractor Log: The Contractor shall maintain a separate log entry for each item of equipment and each sub-system of the System. The log shall list dates and times of all scheduled, routine, and emergency calls. Each emergency call shall be described with details of the nature and causes of emergency steps taken to rectify the situation and specific recommendations to avoid such conditions in the future.
  - 3) The RE or Facility Contracting Officer shall provide the Facility Engineering Officer, two (2) copies of actual reports for evaluation.
    - a) The RE or Facility Contracting Officer shall ensure copies of these reports are entered into the System's official acquisition documents.
    - b) The Facilities Chief Engineer shall ensure copies of these reports are entered into the System's official technical as-installed documents.
- B. Work Not Included: Maintenance and repair service shall not include the performance of any work due to improper use, accidents, other vendor,

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contractor, owner tampering or negligence, for which the Contractor is not directly responsible and does not control. The Contractor shall immediately notify the RE or Facility Contracting Officer in writing upon the discovery of these incidents. The RE or Facility Contracting Officer will investigate all reported incidents and render findings concerning any Contractor's responsibility.

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**SECTION 27 41 31  
MASTER ANTENNA TELEVISION EQUIPMENT AND SYSTEMS**

**PART 1 - GENERAL**

**1.1 SECTION SUMMARY**

- A. Work covered by this document includes design, engineering, labor, material, products, guarantee, training and services for, and incidental to the complete installation of new and fully operating NFPA listed Master Antenna Television (TV) equipment and systems as detailed herein.
- B. Work shall be complete, complete, labeled, VA Central Office (VACO) tested and certified and ready for operation

**1.2 RELATED SECTIONS**

- A. Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA AND SAMPLES.
- B. Section 26 05 21, LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES (600 Volts and Below).
- C. Section 27 10 00, STRUCTURED COMMUNICATIONS SYSTEMS CABLING.
- D. Section 27 05 26, GROUNDING AND BONDING FOR COMMUNICATIONS SYSTEMS.
- E. Section 27 05 33, RACEWAYS AND BOXES FOR COMMUNICATIONS SYSTEMS.
- F. Section 27 10 00, STRUCTURED CABLING.
- G. Section 27 15 00, COMMUNICATIONS HORIZONTAL CABLING.
- H. Section 27 52 23, NURSE CALL/CODE BLUE EQUIPMENT AND SYSTEMS.

**1.3 DEFINITIONS**

- A. Provide: Design, engineer, furnish, install, connect complete, test, certify and guarantee.
- B. Work: Materials furnished and completely installed.
- C. Review of contract drawings: A service by the engineer to reduce the possibility of materials being ordered which do not comply with contract documents. The engineer's review shall not relieve the Contractor of responsibility for dimensions or compliance with the contract documents. The reviewer's failure to detect an error does not constitute permission for the Contractor to proceed in error.
- D. Headquarters Technical Review, for National/VA communications and security, codes, frequency licensing, standards, guidelines compliance:
  - Office of Telecommunications
  - Special Communications Team (0050P2B)
  - 1335 East West Highway - 3rd Floor
  - Silver Spring, Maryland 20910

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(O) 301-734-0350, (F) 301-734-0360

E. Engineer: Electrical Engineering

Cannon Design

2170 Whitehaven Road

Grand Island, NY 14072 716-773-6800

H. Contractor: Radio Contractor; you; successful bidder

**1.4 REFERENCES**

A. The installation shall comply fully with all governing authorities, laws and ordinances, regulations, codes and standards, including, but not limited to:

1. United States Federal Law/Codes:

a. Departments of:

1) CFR, Title 15 - Department of Commerce, Under the Information Technology Management Reform Act (Public Law 104-106), the Secretary of Commerce approves standards and guidelines that are developed by the:

a) Chapter II, National Institute of Standards Technology (NIST - formerly the National Bureau of Standards). Under Section 5131 of the Information Technology Management Reform Act of 1996 and the Federal Information Security Management Act of 2002 (Public Law 107-347), NIST develops - Federal Information Processing Standards Publication (FIPS) 140-2-Security Requirements for Cryptographic Modules.

b) Chapter XXIII, National Telecommunications and Information Administration (NTIA - aka 'Red Book') Chapter 7.8/9 Federal communications Commission (FCC) Title 47 (CFR), Part 15, Radio Frequency Restriction of Use and Compliance in "Safety of Life" Functions and Locations.

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- 2) CFR, Title 29, Department of Labor, Chapter XVII -  
Occupational Safety and Health Administration (OSHA), Part  
1910 - Occupational Safety and Health Standard:

- a) Subpart 7 - Definition and requirements for a National  
Recognized Testing Laboratory (NRTL - 15 Laboratory's, for  
complete list, contact

[http://www.osha.gov/dts/otpca/nrtl/faq\\_nrtl.html](http://www.osha.gov/dts/otpca/nrtl/faq_nrtl.html))

- (1) Underwriter's Laboratories (UL):

65	Standard for Wired Cabinets.
468	Standard for Grounding and Bonding Equipment.
1449	Standard for Transient Voltage Surge Suppressors.
1069	Hospital Signaling and Nurse Call Equipment.
60950-1/2	Information Technology Equipment - Safety.

- (2) Canadian Standards Association (CSA): same tests as for  
UL.

- (3) Communications Certifications Laboratory (CCL): same  
tests as for UL.

- (4) Intertek Testing Services NA, Inc. (ITSNA formerly  
Edison Testing Laboratory [ETL]): same tests as for UL.

- b) Subpart 35, Compliance with NFPA 101 - Life Safety Code.

- c) Subpart 36, Design and construction requirements for exit  
routes.

- d) Subpart 268, Telecommunications.

- e) Subpart 305, Wiring methods, components, and equipment for  
general use.

- 3) Public Law No. 100-527, Department of Veterans Affairs:

- a) Office of Telecommunications: Handbook 6100 -  
Telecommunications.

- b) Office of Cyber and Information Security (OCIS):

- (1) Handbook 6500 - Information Security Program.

- (2) Wireless and Handheld Device Security Guideline Version  
3.2, August 15, 2005.

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- c) Spectrum Management FCC and NTIA Radio Frequency Compliance and Licensing Program.
- d) Office of Cyber and Information Security (OCIS):
  - (1) Handbook 6500 - Information Security Program.
  - (2) Wireless and Handheld Device Security Guideline Version 3.2, August 15, 2005.
- 4) Title 42, CFC, Department of Health, Chapter IV Health and Human Services, Subpart 1395(a)(b) Joint Commission on Accreditation of Healthcare Organizations (JCAHO) "a hospital that meets JCAHO accreditation is deemed to meet the Medicare conditions of Participation by meeting Federal Directives:" All guidelines for Life, Personal and Public Safety; and, Essential and Emergency Communications.
- 5) CFR, Title 47 - Telecommunications, in addition to FCC: Part 15 - Restrictions of use for Part 15 listed Radio Equipment in Safety of Life/Emergency Functions/Equipment/Locations (also see CFR, Title 15 - Department of Commerce, Chapter XXIII - NTIA):

Part 73	Radio Broadcast Service,
Part 90	Rules and Regulations, Appendix C.
Form 854	Antenna Structure Registration.

- 6) Public Law 89-670, Department of Transportation, CFR-49, Part 1, Subpart C - Federal Aviation Administration (FAA):
    - a) Standards AC 110/460-ID and AC 707/460-2E - Advisory Circulars for Constructions of Antenna Towers.
    - b) Forms 7450 and 7460-2 - Antenna Construction Registration.
2. National Codes:
- a. American Institute of Architects (AIA): Guidelines for Healthcare Facilities.

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- b. American National Standards Institute/Electronic Industries Association/Telecommunications Industry Association  
(ANSI/EIA/TIA):

568-C	Commercial Building Telecommunications Wiring Standards:
569-C	Commercial Building Standard for Telecommunications Pathways and Spaces.
606B	Administration Standard for the Telecommunications Infrastructure of Communications Buildings.
607B	Commercial Building Grounding and Bonding Requirements for Telecommunications.
REC 127-49	Power Supplies.
RS 27	Tools, Crimping, Solderless Wiring Devices, Recommended Procedures for User Certification.

- c. Institute of Electrical and Electronics Engineers (IEEE):

SO/TR 21730:2007	Use of mobile wireless communication and computing technology in healthcare facilities - Recommendations for electromagnetic compatibility (management of unintentional electromagnetic interference) with medical devices.
0739- 5175/08/\$25. 00@2008IEEE	Medical Grade - Mission Critical - Wireless Networks.
C62.41	Surge Voltages in Low-Voltage AC Power Circuits.

- d. American Society of Mechanical Engineers (ASME):

- 1) Standard 17.4, Guide for Emergency Personnel.
- 2) Standard 17.5, Elevator and Escalator Equipment (prohibition of installing non-elevator equipment in Elevator Equipment Room/Mechanical Penthouse).

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e. NFPA:

70	National Electrical Code (current date of issue) - Articles 517, 645 and 800.
75	Standard for Protection of Electronic Computer Data- Processing Equipment.
77	Recommended Practice on Static Electricity.
99	Healthcare Facilities.
101	Life Safety Code.

3. State Hospital Code(s).

4. Local Codes.

**1.5 QUALIFICATIONS**

- A. The OEM shall have had experience with three or more installations of systems of comparable size and complexity about type and design as specified herein. Each of these installations shall have performed satisfactorily for at least 1 year after final acceptance by the user. Include the names, locations and point of contact for these installations as a part of the submittal.
- B. The Contractor shall submit certified documentation that they have been an authorized distributor and service organization for the OEM for a minimum of 3 years. The Contractor shall be authorized by the OEM to pass thru the OEM's warranty of the installed equipment to VA. In addition, the OEM and Contractor shall accept complete responsibility for the design, installation, certification, operation, and physical support for the system. This documentation, along with the System Contractor and OEM certifications must be provided in writing as part of the Contractor's Technical submittal.
- C. The Contractor's Communications Technicians assigned to the system shall be fully trained, qualified, and certified by the OEM on the engineering, installation, operation, and testing of the system. The Contractor shall provide formal written evidence of current OEM certification(s) for the installer(s) as a part of the submittal or to the Resident Engineer before being allowed to commence work on the system.
- D. Applicable national, state and local licenses.
- E. Certificate of successful completion of OEM's installation/training school for installing technicians of the equipment being proposed.

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**1.6 CODES AND PERMITS**

- A. Provide all necessary permits and schedule all inspections as identified in the contract's milestone chart, so that the system is proof of performance tested and ready for operation on a date directed by the Resident Engineer.
- B. The contractor is responsible to adhere to all codes described herein and associated contractual, state and local codes.

**1.7 SCHEDULING**

- A. After the award of contract, the Contractor shall prepare a detailed schedule (aka milestone chart) using "Microsoft Project" software or equivalent. The Contractor Project Schedule (CPS) shall indicate detailed activities for the projected life of the project. The CPS shall consist of detailed activities and their restraining relationships. It will also detail manpower usage throughout the project.
- B. It is the responsibility of the Contractor to coordinate all work with the other trades for scheduling, rough-in, and finishing all work specified. The VAMC will not be liable for any additional costs due to missed dates or poor coordination of the supplying contractor with other trades.

**1.8 REVIEW OF CONTRACT DRAWINGS AND EQUIPMENT DATA SUBMITTALS**

- A. Submit at one time within 10 days of contract awarding, drawings and product data on all proposed equipment and system. Check for compliance with contract documents and certify compliance with Contractor's "APPROVED" stamp and signature.
- B. Support all submittals with descriptive materials, i.e., catalog sheets, product data sheets, diagrams, and charts published by the manufacturer. These materials shall show conformance to specification and drawing requirements.
- C. Where multiple products are listed on a single cut-sheet, circle or highlight the one that you propose to use. Provide a complete and through equipment list of equipment expected to be installed in the system, with spares, as a part of the submittal. Special Communications (TVE-0050P3B - herein after referred to as [0050P3B]) will not review any submittal that does not have this list.
- D. Provide 4 copies to the PM for technical review. The PM will provide a copy to the offices identified in Paragraph 1.3.C and D, at a minimum

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for compliance review as described herein where each responsible individual(s) should respond to the PM within 10 days of receipt of their acceptance or rejection of the submittal(s).

- E. Head End and each interface distribution cabinet layout drawing, as they are to be installed.
- F. Equipment technical literature detailing the electrical and technical characteristics of each item of equipment to be furnished.
- G. Engineering drawings of the system, showing calculated signal levels at the Head End input and output, each input and output distribution point, and signal level at each telecommunications outlet.
- H. Antenna Signal Survey:
  - 1. The Contractor shall submit a computerized signal survey for the system radiated and receive RF signals. The survey(s) shall be made by a recognized industry source that is derived mathematically from fixed information and projects an approximation of the signal levels that can be expected at the actual site using a given antenna.
  - 2. The signal survey can usually be obtained from the OEM for the radio equipment at no charge. An on-site survey, using actual transmitting and receiving equipment of the type the Contractor has specified, is an acceptable alternate.
  - 3. The approximate longitude and latitude of the Facility along with the elevation above mean sea level can be obtained from the Resident Engineer.
  - 4. The Contractor shall record all findings on a geographic map with the Facility residing in its center and shall outline all coverage locations, radiating in a 360-degree pattern. The primary, secondary, marginal and out of range areas operation shall be depicted by different colors for each frequency of operation.

**1.9 PROJECT RECORD DOCUMENTS (AS BUILTS)**

- A. Throughout progress of the work, maintain an accurate record of changes in Contract Documents. Upon completion of Work, transfer recorded changes to a set of Project Record Documents.
- B. The floor plans shall be marked in pen to include the following:
  - 1. All device locations with labels.
  - 2. Conduit locations.
  - 3. Head-end equipment and specific location.
  - 4. Wiring diagram.



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5. Labeling and administration documentation.
6. Warranty certificate.
7. System test results.

**1.10 WARRANTIES AND GUARANTEE**

- A. The Contractor shall warrant the installation be free from defect in material and workmanship for a period of 1 year from the date of acceptance of the project by the Resident Engineer. The Contractor shall agree to remedy covered defects within eight (8) hours of notification of major failures or within twenty-four (24) hours of notification for individual station related problems.
- B. Refer to Part 4 for applicable System Guarantee requirements.

**1.11 USE OF THE SITE**

- A. Use of the site shall be at the GC's direction.
- B. Coordinate with the GC for lay-down areas for product storage and administration areas.
- C. Coordinate work with the GC and their sub-contractors.
- D. Access to buildings wherein the work is performed shall be directed by the GC.

**1.12 DELIVERY, STORAGE, AND HANDLING**

- A. Deliver, store, and handle products using means and methods that will prevent damage, deterioration, and loss, including theft.
- B. Store products in original containers.
- C. Coordinate with the GC for product storage. There may be little or no storage space available on site. Plan to potentially store materials off site.
- D. Do not install damaged products. Remove damaged products from the site and replaced with new product at no cost to the VAMC.

**1.13 PROJECT CLOSEOUT**

- A. Prior to final inspection and acceptance of the work, remove all debris, rubbish, waste material, tools, construction equipment, machinery and surplus materials from the project site and thoroughly clean your work area.
- B. Before the project closeout date, the Contractor shall submit:
  1. Warranty certificate.
  2. Evidence of compliance with requirements of governing authorities such as the Low Voltage Certificate of Inspection.
  3. Project record documents.

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4. Instruction manuals and software that is a part of the system.
- C. Contractor shall submit written notice that:
  1. Contract Documents have been reviewed.
  2. Project has been inspected for compliance with contract.
  3. Work has been completed in accordance with the contract

**PART 2 - PRODUCTS AND FUNCTIONAL REQUIREMENTS**

**2.1 GENERAL REQUIREMENTS FOR EQUIPMENT AND MATERIALS**

- A. Furnish and install a complete and fully operational master antenna TV signal distribution system. Include all amplifiers, power supplies, cables, outlets, attenuators, antennas, and all other parts necessary for the reception and distribution of the off-the-air TV signals.
- B. Coordinate features and select components to form an integrated system. Match components and interconnections for optimum performance of specified functions.
- C. Expansion Capability: Increase number of stations in the future by 25 percent above those indicated without adding any internal or external components or main trunk cable conductors.
- D. Distribute cable channels to all TV outlets to permit simple connection of EIA standard high definition television (HDTV) receivers.
- E. Deliver at all outlets all HDTV monochrome and color television signals without introducing noticeable effect on picture and color fidelity or sound. System picture fidelity shall be equal to that received from the cable company and other modulated channels.
- F. Provide reception quality at each outlet equal to or better than that received in the area with individual antennas. Deliver at all television outlets a minimum +6.0 dBmv (2,000 microvolts across 75 Ohms) and maximum of +20 dBmv (20,000 microvolts) for each channel at each outlet.
- G. Equipment: Modular type using solid-state components, fully rated for continuous duty unless otherwise indicated. Select equipment for normal operation on input power usually supplied at 110 to 130 V, 60 Hz.
- H. Meet all FCC requirements regarding low radiation and/or interference of RF signal(s). The system shall be designed to prevent direct pickup of signals from the building structure.
- I. Weather-Resistant Equipment: Listed and labeled by an OSHA certified National Recognized Testing Laboratory (NRTL - i.e. UL) for duty outdoors or in damp locations.

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**2.2 SYSTEM DESCRIPTION**

- A. The Contractor shall continually employ interfacing methods that are approved by the OEM and VA. At a minimum, an acceptable interfacing method requires not only a physical and mechanical connection, but also a matching of signal, voltage, and processing levels with regard to signal quality and impedance. The interface point must adhere to all standards described herein for the full separation of Critical Care and Life Safety systems.
- B. It is not acceptable to utilize the telephone cable system for the control of MATV signals and equipment. The System Contractor shall connect the system ensuring that all NFPA and Underwriters Laboratory, Inc. (UL) Critical Care and Life Safety Circuit and system separation guidelines are satisfied. The System Contractor is not allowed to make any connections to the Telephone System. The Resident Engineer shall arrange for the interconnection between the MATV, Nurses Call Systems with the appropriate responsible parties.
- C. All passive distribution equipment shall meet or exceed -80 dB radiation shielding specifications and be provided with screw type audio connectors.
- D. All trunk, branch, and interconnecting cables and unused equipment ports or taps shall be terminated with proper terminating resistors designed for RF, audio and digital cable systems without adapters.
- E. The system shall utilize microprocessor components for all signaling and programming circuits and functions. System program memory shall be non-volatile or protected from erasure from power outages for FG.
- F. Provide a backup battery or a UPS for the system (including each distribution cabinet/point) to allow normal operation and function (as if there was no AC power failure) in the event of an AC power failure or during input power fluctuations for a minimum of 30 minutes.
- G. Plug-in connectors shall be provided to connect all equipment, except coaxial cables and RF transmission line interface points. Coaxial cable distribution points and RF transmission lines shall use coaxial cable connections recommended by the cable OEM and approved by the system OEM. Base band cable systems shall utilize barrier terminal screw type connectors, at a minimum. As an alternate, crimp type connectors installed with a ratchet type installation tool are acceptable provided the cable dress, pairs, shielding, grounding, connections and labeling

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are the same as the barrier terminal strip connectors. Tape of any type, wire nuts or solder type connections are unacceptable and will not be approved.

- H. All equipment faceplates utilized in the system shall be stainless steel, anodized aluminum or UL approved cyclac plastic for the areas where provided.
- I. Noise filters and surge protectors shall be provided for each equipment interface cabinet, Head End cabinet, control console and local and remote ampler locations to insure protection from input primary AC power surges and to insure noise glitches are not induced into low voltage data circuits.
- J. Audio Level Processing: The use of telephone cable to distribute MATV signals, carrying system or sub-system AC or DC voltage is not acceptable and will not be approved. Additionally, each control location shall be provided with the equipment required to insure the system can produce its designed audio channel capacity at TV/speaker identified on the contract drawings.
- K. Contractor is responsible for pricing all accessories and miscellaneous equipment required to form a complete and operating system. Unless otherwise noted in this Part, equipment quantities shall be as indicated on the drawings.

**2.3 MANUFACTURERS**

- A. The products specified shall be new, FCC and UL Listed, and produced by OEM manufacturer of record. An OEM of record shall be defined as a company whose main occupation is the manufacture for sale of the items of equipment supplied and which:
  - 1. Maintains a stock of replacement parts for the item submitted,
  - 2. Maintains engineering drawings, specifications, and operating manuals for the items submitted, and
  - 3. Has published and distributed descriptive literature and equipment specifications on the items of equipment submitted at least 30 days prior to the Invitation for Bid.
- B. Specifications contained herein as set forth in this document detail the salient operating and performance characteristics of equipment in order for VA to distinguish acceptable items of equipment from unacceptable items of equipment. When an item of equipment is offered or furnished for which there is a specification contained herein, the

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item of equipment offered or furnished shall meet or exceed the specification for that item of equipment.

- C. The equipment items are the salient requirements of VA to provide an acceptable system described herein.

**2.4 PRODUCTS**

- A. The system distribution amplifier shall have a frequency range of 49-1,000 MHz and shall accommodate a minimum of 35 HDTV channels of programming. Gain of the preamplifier shall be 32dB, with an output level of 48dBmV for each HDTV channel processed. The preamplifier shall utilize a hybrid push-pull amplifier module. The preamplifier shall provide gain and slope control ranges of 8dB and 9dB, respectively.
- B. Provide one 8-port passive combiner for the combining of all RF signals into one main trunk run for distribution to all building locations. Bandwidth of combiners shall be 0 to 1,000MHz.
- C. Provide riser rated coaxial cable with a nominal characteristic impedance of 75 Ohms throughout the entire frequency spectrum utilized in this system. Each reel of cable shall be sweep-tested and return-loss tested over the entire frequency range from 50MHz to 750MHz by the manufacturer. Provide RG-6, RG-11 or appropriate minimum .500" Hardline Coaxial cable as required to achieve the specified signal level. However, all runs over 150' in length shall be RG-11 or .500".
- D. Line Splitters:
1. Provide low-radiation line splitters with a flat frequency response from 50MHz to 1,000MHz. Provide units of a hybrid design with a 75-ohm match on input and outputs and a VSWR no greater than 1.4:1.
  2. Two way line splitters shall have a signal loss of not more than 3.5dB at each output.
  3. Four way line splitters shall have a signal loss of not more than 7.2dB at each output.
  4. All unused splitter outputs shall be terminated with 75-Ohm terminations.
- E. HDTV Outlets:
1. Provide outlets at each location shown on the plans. Mount in electrical contractor provided 6" square, 2-1/2" deep minimum flush electrical boxes as indicated on plans.
  2. Provisions shall be incorporated in the network to prevent 60 Hz AC or DC feedback into the distribution lines.

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3. Outlets shall be designed to cover a frequency range of 10MHz to 1,000MHz. Insertion loss shall not exceed 1.0 db at any frequency within the designated frequency range for a 17dB isolation network. Outlets shall be back-matched from 10 to 1,000MHz. Outlets shall have one F-type connector on the front and two F-type connectors on the rear.

4. The minimum isolation value between any two outlets shall be 24 db.

F. Television Receivers shall be provided separately by the VAMC.

G. Distribution Devices:

1. Distribution Amplifier:

a. Description: Broadband CATV quality HDTV distribution amplifier.

b. Specifications:

Frequency Range: 49MHz to 1,000MHz.	Channel Loading: 150.
Flatness: +/- .75dB.	Gain: 32dB.
Output Level: +40dBmV.	Gain Control Range: 10dB.
Slope Control Range: 8dB.	Plug in equalizers as needed.
Attenuator options as needed.	

2. Splitters:

a. Description: RF signal splitter.

b. Specifications:

Frequency Range: 5MHz to 1,000MHz.	Outputs: 2, 3, 4 and 8.
Splitter Loss: less than 12 dB.	RFI Shielding: 120dB.

3. Taps:

a. Description: Directional Coupler Type Taps.

b. For use in Telecomm closets or accessible cable trays.

c. Specifications:

1. Frequency Range: 5MHz to 1,000MHz.

2. Outputs: 2, 4 and 8.

3. Isolation Tap Value: Varies.

4. Wallplate Bulkhead Connector and Terminators:

a. Description: Wall plates for termination of CATV signals at television sets.

1. Impedance: 75 Ohms.

2. Frequency Band: SUB/VHF/CATV/UHF.

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5. "F" Connectors:

- a. Coaxial cable connectors and connector inserts shall be designed to provide maximum performance with the cable to be used. Coaxial cables shall be connectorized with the Head End quality 360 degree F or BNC connectors as applicable, meeting or exceeding standard industry and the cable manufacture's specifications. All drop F-connectors shall be hex type crimp or a "Snap and Seal" type connector. Housing to housing (KS to KS) type or 90-degree type connectors shall be used where specified by the OEM.

6. Terminator:

- a. Description: 75-Ohm terminator.
- b. Specifications:

DC blocking.	Bandwidth: 50MHz-890MHz.
Return Loss: greater than 16dB.	Impedance: 75 Ohm.

7. Trunk Cable:

- a. Description: .500 inch, Semi-Rigid Coax, Riser Rated.
- b. Specifications:

1. Maximum Attenuation:

2.92 dB/100ft at 700 MHz.	3.78 dB/100ft at 1000 MHz.
Impedance: 75 Ohm	

8. RG6 Cable:

- a. Description: CATV RG6 double shielded cable CM Rated
- b. Specifications:

1. Attenuation:

1.48 dB/100ft at 50 MHz.	7.45 dB/100ft at 1000 MHz.
Impedance: 75 Ohm	

9. RG11 Cable:

- a. Description: CATV RG11 cable CM Rated
- b. Specifications:

1. Attenuation:

0.90 dB/100ft at 50 MHz.	5.04 dB/100ft at 1000 MHz.
Impedance: 75 Ohm	

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**PART 3 - EXECUTION**

**3.1 PROJECT MANAGEMENT**

- A. Assign a single project manager to this project who will serve as the point of contact for the Resident Engineer, the General Contractor, and the Engineer.
- B. The Contractor shall be proactive in scheduling work at the hospital, specifically the Contractor will initiate and maintain discussion with the general contractor regarding the schedule for ceiling cover up and install cables to meet that schedule.
- C. Contact the Office of Telecommunications, Special Communications Team (0050P3B) at (301) 734-0350 to have a VA Certified Telecommunications COTR assigned to the project for telecommunications review, equipment and system approval and co-ordination with VA's Spectrum Management and OCIS Teams.

**3.2 COORDINATION WITH OTHER TRADES**

- A. Coordinate with the cabling contractor the location of the faceplate and the faceplate opening for the MATV backbox.
- B. Coordinate with the cabling contractor the location of MATV equipment in the Telecommunications Closets.
- C. Before beginning work, verify the location, quantity, size and access for the following:
  - Isolated ground AC power circuits provided for systems.
  - Primary, emergency and extra auxiliary AC power generator requirements.
  - Junction boxes, wall boxes, wire troughs, conduit stubs and other related infrastructure for the systems.
  - System components installed by others.
  - Overhead supports and rigging hardware installed by others.
- D. Immediately notify the Resident Engineer, General Contractor and Consultant in writing of any discrepancies.

**3.3 NEEDS ASSESSMENT**

Provide a one-on-one meeting with the particular nursing manager of each unit affected by the installation of the new HDTV MATV system. Review the floor plan drawing, educate the nursing manager with the functions of the equipment that is being provided and gather details specific to the individual units; coverage and priorities of calls; staffing patterns; and other pertinent details that will affect system programming and training.



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**3.4 INSTALLATION**

A. General:

1. Execute work in accordance with National, State and local codes, regulations and ordinances.
2. Install work neatly, plumb and square and in a manner consistent with standard industry practice. Carefully protect work from dust, paint and moisture as dictated by site conditions. The Contractor will be fully responsible for protection of his work during the construction phase up until final acceptance by the VAMC.
3. Install equipment according to OEM's recommendations. Provide any hardware, adaptors, brackets, rack mount kits or other accessories recommended by OEM for correct assembly and installation.
4. Secure equipment firmly in place, including receptacles, speakers, equipment racks, system cables, etc:
  - a. All supports, mounts, fasteners, attachments and attachment points shall support their loads with a safety factor of at least 5:1.
  - b. Do not impose the weight of equipment or fixtures on supports provided for other trades or systems.
  - c. Any suspended equipment or associated hardware must be certified by the OEM for overhead suspension.
  - d. The Contractor is responsible for means and methods in the design, fabrication, installation and certification of any supports, mounts, fasteners and attachments.
5. Locate overhead ceiling-mounted loudspeakers as shown on drawings, with minor changes not to exceed 12 inches in any direction:
  - a. Mount transformers securely to speaker brackets or enclosures using screws. Adjust torsion springs as needed to securely support speaker assembly.
  - b. Speaker back boxes shall be completely filled with fiberglass insulation.
  - c. Seal cone speakers to their enclosures to prevent air passing from one side of the speaker to the other.
6. Finishes for any exposed work such as plates, racks, panels, speakers, etc. shall be approved by the Architect, Resident Engineer and 0050P3B.

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7. Coordinate cover plates with field conditions. Size and install cover plates as necessary to hide joints between back boxes and surrounding wall. Where cover plates are not fitted with connectors, provide grommets in size and quantity required. Do not allow cable to leave or enter boxes without cover plates installed.

**B. Equipment Racks:**

1. Fill unused equipment mounting spaces with blank panels or vent panels. Match color to equipment racks.
2. Provide security covers for all devices not requiring routine operator control.
3. Provide vent panels and cooling fans as required for the operation of equipment within the OEM' specified temperature limits. Provide adequate ventilation space between equipment for cooling. Follow manufacturer's recommendations regarding ventilation space between amplifiers.
4. Provide insulated connections of the electrical raceway to equipment racks.
5. Provide continuous raceway and conduit with no more than 40 percent fill between wire troughs and equipment racks for all non-plenum-rated cable. Ensure each system is mechanically separated from each other in the wireway.

**C. Wiring Practice - in addition to the mandatory infrastructure requirements outlined in VA Construction Specification, Section 27 10 00, STRUCTURED COMMUNICATIONS CABLING SYSTEM, the following additional practices shall be adhered to:**

1. Comply with requirements for raceways and boxes specified in Division 26, Section 26 05 33, RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS.
2. Execute all wiring in strict adherence to the National Electrical Code, applicable local building codes and standard industry practices.
3. Where raceway is to be EMT (conduit), wiring of differing classifications shall be run in separate conduit. Where raceway is to be an enclosure (rack, tray, wire trough, utility box) wiring of differing classifications, which share the same enclosure, shall be mechanically partitioned and separated by at least 4 inches. Where

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- Wiring of differing classifications must cross, they shall cross perpendicular to one another.
4. Do not splice wiring anywhere along the entire length of the run. Make sure cables are fully insulated and shielded from each other and from the raceway for the entire length of the run.
  5. Do not pull wire through any enclosure where a change of raceway alignment or direction occurs. Do not bend wires to less than radius recommended by manufacturer.
  6. Replace the entire length of the run of any wire or cable that is damaged or abraided during installation. There are no acceptable methods of repairing damaged or abraided wiring.
  7. Use wire pulling lubricants and pulling tensions as recommended by the OEM.
  8. Use grommets around cut-outs and knock-outs where conduit or chase nipples are not installed.
  9. Do not use tape-based or glue-based cable anchors.
  10. Ground shields and drain wires as indicated by the drawings.
  11. Field wiring entering equipment racks shall be terminated as follows:
    - a. Provide ample service loops at harness break-outs and at plates, panels and equipment. Loops should be sufficient to allow plates, panels and equipment to be removed for service and inspection.
    - b. Line level and speaker level wiring may be terminated inside the equipment rack using specified terminal blocks (see "Products"). Provide 15 percent spare terminals inside each rack. Microphone level wiring may only be terminated at the equipment served.
    - c. If specified terminal blocks are not designed for rack mounting, utilize 3/4 inch plywood or 1/8 inch thick aluminum plates/blank panels as a mounting surface. Do not mount on the bottom of the rack.
    - d. Employ permanent strain relief for any cable with an outside diameter of 1 inch or greater.
  12. Use only balanced audio circuits unless noted otherwise
  13. Make all connections as follows:
    - a. Make all connections using rosin-core solder or mechanical connectors appropriate to the application.

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- b. For crimp-type connections, use only tools that are specified by the manufacturer for the application.
  - c. Use only insulated spade lugs on screw terminals. Spade lugs shall be sized to fit the wire gauge. Do not exceed two lugs per terminal.
  - d. Wire nuts, electrical tape or "Scotch Lock" connections are not acceptable for any application.
- D. Cable Installation - In addition to the mandatory infrastructure requirements outlined in VA Construction Specification, Section 27 10 00, STRUCTURED CABLING the following additional practices shall be adhered to:
- 1. Support cable on maximum 4'-0" centers. Acceptable means of cable support are cable tray, j-hooks, and bridal rings. Velcro wrap cable bundles loosely to the means of support with plenum rated Velcro straps. Plastic tie wraps are not acceptable as a means to bundle cables.
  - 2. Run cables parallel to walls.
  - 3. Install maximum of 10 cables in a single row of J-hooks. Provide necessary rows of J-hooks as required by the number of cables.
  - 4. Do not lay cables on top of light fixtures, ceiling tiles, mechanical equipment, or ductwork. Maintain at least 2'-0" clearance from all shielded electrical apparatus.
  - 5. All cables shall be tested after the total installation is fully complete. All test results are to be documented. All cables shall pass acceptable test requirements and levels. Contractor shall remedy any cabling problems or defects in order to pass or comply with testing. This includes the re-pull of new cable as required at no additional cost to the VAMC.
  - 6. Ends of cables shall be properly terminated on both ends per industry and OEM's recommendations.
  - 7. Provide proper temporary protection of cable after pulling is complete before final dressing and terminations are complete. Do not leave cable lying on floor. Bundle and tie wrap up off of the floor until you are ready to terminate.
  - 8. Cover the end of the overall jacket with a 1 inch (minimum) length of transparent heat-shrink tubing. Cut unused insulated conductors 2 inches (minimum) past the heat-shrink, fold back over jacket and

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secure with cable-tie. Cut unused shield/drain wires 2 inches (minimum) past the Heatshrink and serve as indicated below.

9. Cover shield/drain wires with heat-shrink tubing extending back to the overall jacket. Extend tubing 1/4 inch past the end of unused wires, fold back over jacket and secure with cable tie.
10. For each solder-type connection, cover the bare wire and solder connection with heat-shrink tubing.
11. Terminate conductors; no cable shall contain unterminated elements. Make terminations only at outlets and terminals.
12. Splices, Taps, and Terminations: Arrange on numbered terminal strips in junction, pull, and outlet boxes; terminal cabinets; and equipment enclosures. Cables may not be spliced.
13. Bundle, lace, and train conductors to terminal points without exceeding OEM's limitations on bending radii. Install lacing bars and distribution spools.
14. Cold-Weather Installation: Bring cable to room temperature before dereeling. Heat lamps shall not be used.
15. Cable shall not be run through structural members or be in contact with pipes, ducts, or other potentially damaging items.

**E. Labeling:**

1. Clearly, consistently, logically and permanently mark switches, connectors, jacks, relays, receptacles and electronic and other equipment.
2. Engrave and paint fill all receptacle panels using 1/8 inch (minimum) high lettering and contrasting paint.
3. For rack-mounted equipment, use engraved Lamacoid labels with white 1/8 inch (minimum) high lettering on black background. Label the front and back of all rack-mounted equipment.
4. Where multiple pieces of equipment reside in the same rack group, clearly and logically label each indicating to which room, channel, receptacle location, etc. they correspond.
5. Permanently label cables at each end, including intra-rack connections. Labels shall be covered by the same, transparent heat-shrink tubing covering the end of the overall jacket. Alternatively, computer generated labels of the type which include a clear protective wrap may be used.

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6. Contractor's name shall appear no more than once on each continuous set of racks. The Contractor's name shall not appear on wall plates or portable equipment.
7. Ensure each OEM supplied equipment has permanently attached/marked the appropriate UL Labels/Marks for the service the equipment is performed. Equipment installed not bearing these UL marks will not be allowed to be part of the system. The Contractor shall bear all costs required to provide replacement equipment with approved UL marks.

**3.5 PROTECTION OF NETWORK DEVICES**

Contractor shall protect network devices during unpacking and installation by wearing manufacturer approved electrostatic discharge (ESD) wrist straps tied to chassis ground. The wrist strap shall meet OSHA requirements for prevention of electrical shock, should technician encounter high voltage.

**3.6 CUTTING AND PATCHING**

- A. It shall be the responsibility of the contractor to keep their work area clear of debris and clean area daily at completion of work.
- B. It shall be the responsibility of the contractor to patch and paint any wall or surface that has been disturbed by the execution of this work.
- C. The Contractor shall be responsible for providing any additional cutting, drilling, fitting or patching required that is not indicated as provided by others to complete the Work or to make its parts fit together properly.
- D. The Contractor shall not damage or endanger a portion of the Work or fully or partially completed construction of the VAMC or separate contractors by cutting, patching or otherwise altering such construction, or by excavation. The Contractor shall not cut or otherwise alter such construction by the VAMC or a separate contractor except with written consent of the Resident Engineer and of such separate contractor; such consent shall not be unreasonably withheld. The Contractor shall not unreasonably withhold from the Resident Engineer or a separate Contractor, the Contractor's consent to cutting or otherwise altering the work.
- E. Where coring of existing (previously installed) concrete is specified or required, including coring indicated under unit prices, the location of such coring shall be clearly identified in the field and the

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location shall be approved by the Project Manager prior to commencement of coring work.

**3.7 FIREPROOFING**

- A. Where MATV cables penetrate fire rated walls, floors and ceilings, fireproof the opening.
- B. Provide conduit sleeves (if not already provided by electrical contractor) for cables that penetrate fire rated walls. After the cabling installation is complete, install fire proofing material in and around all conduit sleeves and openings. Install fire proofing material thoroughly and neatly. Seal all floor and ceiling penetrations.
- C. Use only materials and methods that preserve the integrity of the fire stopping system and its rating.

**3.8 GROUNDING**

- A. Ground cable shields and equipment to eliminate shock hazard and to minimize ground loops, commonmode returns, noise pickup, cross talk, and other impairments.
- B. Signal Ground Terminal: Locate at main equipment cabinet. Isolate from power system and equipment grounding.
- C. Install grounding electrodes as specified in Division 26, Section 26 05 26, GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS.
- D. Do not use "3rd or 4th" wire internal electrical system conductors for ground.
- E. Do not connect system ground to the building's external lightning protection system.
- F. Do not "mix grounds" of different systems.

**PART 4 - TESTING/GUARANTEE/TRAINING**

**4.1 SYSTEM CLASSIFICATION**

The HDTV MATV System is FCC and NFPA listed. Therefore, the following testing and guaranty provisions are the minimum to be performed and provided by the contractor and Warranted by the OEM.

**4.2 PROOF OF PERFORMANCE TESTING**

- A. Intermediate Testing:
  - 1. After completion of 25 - 30 percent of the installation of a head end cabinet(s) and equipment, one wing of HDTV MATV outlets and prior to any further work, this portion of the system must be pretested, inspected, and certified. Each item of installed equipment shall be checked to ensure appropriate FCC listing and UL

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certification labels are affixed, NFPA, Emergency, Safety, and JCAHCO guidelines are followed, and proper installation practices are followed. The intermediate test shall include a full operational test.

2. The inspection and test will be conducted by a factory-certified contractor representative and witnessed by a Government Representative. The results of the inspection will be officially recorded by a local Government Representative and maintained on file by the Resident Engineer (RE), until completion of the entire project. The results will be compared to the Acceptance Test results. An identical inspection may be conducted between the 65 - 75 percent of the system construction phase, at the direction of the Resident Engineer.

**B. Pretesting:**

1. Upon completing installation of the system, the Contractor shall align, balance, and completely pretest the entire system under full operating conditions.
2. Pretesting Procedure:
  - a. During the system pretest the Contractor shall verify (utilizing approved test equipment) that the system is fully operational and meets all the system performance requirements of this standard.
  - b. The Contractor shall pretest and verify that all system functions and specification requirements are met and operational, no unwanted aural effects, such as signal distortion, noise pulses, glitches, audio hum, poling noise, etc. are present. At a minimum, each of the following locations shall be fully pretested:
    - 1) All Networked locations.
3. The Contractor shall provide 4 copies of the recorded system pretest measurements and the written certification that the system is ready for the formal acceptance test shall be submitted to the Resident Engineer.

**C. Acceptance Test:**

1. After the system has been pre-tested and the Contractor has submitted the pretest results and certification to the Resident Engineer, then the Contractor shall schedule an acceptance test date and give the Resident Engineer 30 days written notice prior to the



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date the acceptance test is expected to begin. The system shall be tested in the presence of a Government Representative and an OEM certified representative. The system shall be tested utilizing the approved test equipment to certify proof of performance and FCC compliance. The test shall verify that the total system meets all the requirements of this specification. The notification of the acceptance test shall include the expected length (in time) of the test.

2. The acceptance test shall be performed on a "go-no-go" basis. Only those operator adjustments required to show proof of performance shall be allowed. The test shall demonstrate and verify that the installed system does comply with all requirements of this specification under operating conditions. The system shall be rated as either acceptable or unacceptable at the conclusion of the test. Failure of any part of the system that precludes completion of system testing, and which cannot be repaired in 4 hours, shall be cause for terminating the acceptance test of the system. Repeated failures that result in a cumulative time of 8 hours to affect repairs shall cause the entire system to be declared unacceptable. Retesting of the entire system shall be rescheduled at the convenience of the Government.

**D. Acceptance Test Procedure:**

**1. Physical and Mechanical Inspection:**

- a. The VACO Government Representative will tour all major areas where the system is and all sub-systems are completely and properly installed to insure they are operationally ready for proof of performance testing. A system inventory including available spare parts will be taken at this time. Each item of installed equipment shall be checked to ensure appropriate UL certification labels are affixed.
- b. The system diagrams, record drawings, equipment manuals, Telecommunications Infrastructure Plant (TIP) Auto CAD Disks, intermediate, and pretest results shall be formally inventoried and reviewed.
- c. Failure of the system to meet the installation requirements of this specification shall be grounds for terminating all testing.

**2. Operational Test:**

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- a. After the Physical and Mechanical Inspection, head end terminating and control equipment shall be checked to verify that it meets all performance requirements outlined herein. A spectrum analyzer and sound level meter shall be utilized to accomplish this requirement.
  - b. Following the Head End equipment test, the local control unit be connected to the Head End equipment's output test tap to ensure there are no signal distortions such as intermodulation, data noise, popping sounds, erratic system functions, on any function.
  - c. The distribution system shall be checked at each interface, junction, and distribution point, first, middle, and last leg to verify that the HDTV MATV video, audio and control signals meets all system performance standards.
  - d. Each HDTV MATV outlet shall be functionally tested at the same time utilizing the Contractor's approved hospital grade TV receiver and Spectrum Analyzer.
  - e. The red system and volume stepper switches shall be checked to insure proper operation of the pillow speaker, the volume stepper and the red system (if installed).
  - f. Once these tests have been completed, each installed sub-system function shall be tested as a unified, functioning and fully operating system.
  - g. Individual Item Test: The VACO Government Representative will select individual items of equipment for detailed proof of performance testing until 100percent of the system has been tested and found to meet the contents of this specification. Each item shall meet or exceed the minimum requirements of this document.
3. Test Conclusion:
- a. At the conclusion of the Acceptance Test, using the generated punch list (or discrepancy list) the VA and the Contractor shall jointly agree to the results of the test, and reschedule testing on deficiencies and shortages with the Resident Engineer. Any retesting to comply with these specifications will be done at the Contractor's expense.
  - b. If the system is declared unacceptable without conditions, all rescheduled testing expenses will be borne by the Contractor.

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**E. Acceptable Test Equipment:**

1. The test equipment shall furnished by the Contractor shall have a calibration tag of an acceptable calibration service dated not more than 12 months prior to the test. As part of the submittal, a test equipment list shall be furnished that includes the make and model number of the following type of equipment as a minimum:
  - a. Spectrum Analyzer.
  - b. Signal Level Meter.
  - c. Volt-Ohm Meter.
  - d. Sound Pressure Level (SPL) Meter.
  - e. Oscilloscope.
  - f. Pillow Speaker Test Set (Pillow Speaker with appropriate load and cross connections in lieu of the set is acceptable).

**4.3 SYSTEM GUARANTEE PERIOD OF SERVICE**

**A. Contractor's Responsibility:**

1. The Contractor shall guarantee that all provided material and equipment will be free from defects, workmanship and will remain so for a period of one year from date of final acceptance of the system by the VA. The Contractor shall provide OEM's equipment warranty documents, to the Resident Engineer (or Facility Contracting Officer if the Facility has taken possession of the building), that certifies each item of equipment installed conforms to OEM published specifications.
2. The Contractor's maintenance personnel shall have the ability to contact the Contractor and OEM for emergency maintenance and logistic assistance, remote diagnostic testing, and assistance in resolving technical problems at any time. This contact capability shall be provided by the Contractor and OEM at no additional cost to the VA.
3. All Contractor maintenance and supervisor personnel shall be fully qualified by the OEM and must provide 2 copies of current and qualified OEM training certificates and OEM certification upon request.
4. Additionally, the Contractor shall accomplish the following minimum requirements during the Two Year Guarantee Period:
  - a. Response Time during the Two Year Guarantee Period:

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- 1) The Resident Engineer (or Facility Contracting Officer if the system has been turned over to the Facility) is the Contractor's only official reporting and contact official for MATV system trouble calls, during the guarantee period.
  - 2) A standard work week is considered 8:00 A.M. to 5:00 P.M. or as designated by the Resident Engineer (or Facility Contracting Officer), Monday through Friday exclusive of Federal Holidays.
  - 3) The Contractor shall respond and correct on-site trouble calls, during the standard work week to:
    - a) A routine trouble call within 1 working day of its report. A routine trouble is considered a trouble that causes a pillow speaker or cordset, 1 master IC control station, room station or emergency station to be inoperable.
    - b) Routine trouble calls in critical emergency health care facilities (i.e., cardiac arrest, intensive care units, etc.) shall also be deemed as an emergency trouble call. The Resident Engineer (or Facility Contracting Officer) shall notify the Contractor of this type of trouble call.
    - c) An emergency trouble call within 4 hours of its report. An emergency trouble is considered a trouble that causes a sub-system (ward), distribution point, terminal cabinet, or all call system to be inoperable at anytime.
  - 4) If a HDTV MATV component failure cannot be corrected within 6 hours (exclusive of the standard work time limits), the Contractor shall be responsible for providing alternate HDTV MATV equipment. The alternate equipment/system shall be operational within a maximum of 18 hours after the 6 hour trouble shooting time and restore the effected location operation to meet the system performance standards. If any sub-system or major system trouble cannot be corrected within one working day, the Contractor shall furnish and install compatible substitute equipment returning the system or sub-system to full operational capability, as described herein, until repairs are complete.
- b. Required On-Site Visits during the One Year Guarantee Period:

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- 1) The Contractor shall visit, on-site, as necessary, during the guarantee period, to perform system preventive maintenance, equipment cleaning, and operational adjustments to maintain the system according the descriptions identified in this document.
- 2) The Contractor shall arrange all Facility visits with the Resident Engineer (or Facility Contracting Officer) prior to performing the required maintenance visits.
- 3) Preventive maintenance shall be performed by the Contractor in accordance with the OEM's recommended practice and service intervals during non-busy time agreed to by the Resident Engineer (or Facility Contracting Officer) and Contractor.
- 4) The preventive maintenance schedule, functions and reports shall be provided to and approved by the Resident Engineer (or Facility Contracting Officer).
- 5) The Contractor shall provide the Resident Engineer (or Facility Contracting Officer) a type written report itemizing each deficiency found and the corrective action performed during each required visit or official reported trouble call. The Contractor shall provide the Resident Engineer with sample copies of these reports for review and approval at the beginning of the Acceptance Test. The following reports are the minimum required:
  - a) The Contractor shall provide a monthly summary all equipment and sub-systems serviced during this guarantee period to Resident Engineer (or Facility Contracting Officer) by the fifth (5th) working day after the end of each month. The report shall clearly and concisely describe the services rendered, parts replaced and repairs performed. The report shall prescribe anticipated future needs of the equipment and systems for preventive and predictive maintenance.
  - b) The Contractor shall maintain a separate log entry for each item of equipment and each sub-system of the system. The log shall list dates and times of all scheduled, routine, and emergency calls. Each emergency call shall be described with details of the nature and causes of emergency steps

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taken to rectify the situation and specific recommendations to avoid such conditions in the future.

6) The Resident Engineer (or Facility Contracting Officer) shall convey to the Facility Engineering Officer, 2 copies of actual reports for evaluation.

a) The Resident Engineer (or Facility Contracting Officer) shall ensure a copy of these reports is entered into the system's official acquisition documents.

b) The Facility Chief Engineer shall ensure a copy of these reports is entered into the system's official technical record documents.

B. Work Not Included: Maintenance and repair service shall not include the performance of any work due to improper use; accidents; other vendor, contractor, or VAMC tampering or negligence, for which the Contractor is not directly responsible and does not control. The Contractor shall immediately notify the Resident Engineer or Facility Contracting Officer in writing upon the discovery of these incidents. The Resident Engineer or Facility Contracting Officer will investigate all reported incidents and render

**4.4 TRAINING**

A. Provide thorough training of the VAMC's engineering and maintenance staff.

B. Provide the following minimum training times and durations:

1. 24 hours prior to opening.

2. 24 hours during the opening week.

3. 24 hours for supervisors and system administrators.

- - - E N D - - -

SECTION 27 51 16  
SOUND MASKING PUBLIC ADDRESS AND MASS NOTIFICATION SYSTEMS

PART 1 - GENERAL

1.1 SECTION SUMMARY

- A. Specification includes all components required for a networked based Paging and Sound Masking System including but not limited to digital signal processors, noise generators, paging interfaces, amplifiers, loudspeakers, the associated wiring and controls and components to generate, amplify, distribute and reproduce voice pages and stabilized background sound masking. Work covered by this document includes design, engineering, labor, material and products, equipment warranty and system warranty, training and services for, and incidental to, the complete installation of new and fully operating National Fire Protection Association (NFPA) - Life Safety Code 101.3-2 (a) Labeled and (b) Listed Emergency Service Public Address System (PAS) and associated equipment (here-in-after referred to as the System) in approved locations indicated on the contract drawings. These items shall be tested and certified capable of receiving, distributing, interconnecting and supporting PAS communications signals generated local and remotely as detailed herein.
- B. Work shall be complete, Occupational Safety and Health Administration (OSHA), National Recognized Testing Laboratory (NRTL - i.e. Underwriters Laboratory [UL]) Listed and Labeled; and VA Central Office (VACO), Telecommunications Voice Engineering (TVE 0050P3B) tested, certified and ready for operation.
- C. The System shall be delivered free of engineering, manufacturing, installation, and functional defects. It shall be designed, engineered and installed for ease of operation, maintenance, and testing.
- D. The term "provide", as used herein, shall be defined as: designed, engineered, furnished, installed, certified, and tested, by the Contractor.
- E. Specification Order of Precedence: In the event of a conflict between the text of this document and the Project's Contract Drawings outlined and/or cited herein; THE TEXT OF THIS DOCUMENT TAKES PRECEDENCE.  
*HOWEVER, NOTHING IN THIS DOCUMENT WILL SUPERSEDE APPLICABLE EMERGENCY LAWS AND REGULATIONS, SPECIFICALLY NATIONAL AND/OR LOCAL LIFE AND PUBLIC SAFETY CODES.* The Local Fire Marshall and/or VA Public Safety Officer are the only authorities that may modify this document's

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EMERGENCY CODE COMPLIANCE REQUIREMENTS, on a case by case basis, in writing and confirmed by VA's PM, RE and TVE-0050P3B. The VA PM is the only approving authority for other amendments to this document that may be granted, on a case by case basis, in writhing with technical concurrencies by VA's RE, TVE-0050P3B and identified Facility Project Personnel.

- F. The Original Equipment Manufacturer (OEM) and Contractor shall ensure that all management, sales, engineering and installation personnel have read and understand the requirements of this specification before the system is designed, engineered, delivered and provided. The Contractor shall furnish a written statement attesting this requirement as a part of the technical submittal that includes each name and certification, including the OEMs.

**1.2 RELATED SECTIONS**

- A. 01 33 23 - Shop Drawings, Product Data and Samples.
- B. 07 84 00 - Firestopping.
- C. 26 05 21 - Low - Voltage Electrical Power Conductors and Cables (600 Volts and Below).
- D. 26 41 00 - Facility Lightning Protection.
- E. 27 05 11 - Requirements for Communications Installations.
- F. 27 05 26 - Grounding and Bonding for Communications Systems.
- G. 27 05 33 - Raceways and Boxes for Communications Systems.
- H. 27 10 00 - Structured Communications Cabling Equipment and Systems.
- I. 27 11 00 - Communications Cabling Interface and Equipment Rooms Fittings.
- J. 27 15 00 - Horizontal and Vertical Communications Cabling Equipment and Systems.

**1.3 DEFINITIONS**

- A. Provide: Design, engineer, furnish, install, connect complete, test, certify and warranty.
- B. Work: Materials furnished and completely installed.
- C. Review of contract drawings: A service by the engineer to reduce the possibility of materials being ordered which do not comply with contract documents. The engineer's review shall not relieve the Contractor of responsibility for dimensions or compliance with the contract documents. The reviewer's failure to detect an error does not constitute permission for the Contractor to proceed in error.



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- D. Headquarters Technical Review, for National and VA communications and security, codes, frequency licensing, standards, guidelines compliance:

Office of Telecommunications  
Special Communications Team (0050P2B)  
1335 East West Highway - 3rd Floor  
Silver Spring, Maryland 20910  
(O) 301-734-0350, (F) 301-734-0360

- E. Engineer: Cannon Design  
360 Madison Avenue  
New York, NY  
10017-7111  
212-972-9800

- F. VAMC: VA NY HARBOR HEALTHCARE SYSTEMS

- G. General Contractor (GC): //XXXXXXX//

- H. Contractor: Radio Contractor; you; successful bidder

**1.4 REFERENCES**

- A. The installation shall comply fully with all governing authorities, laws and ordinances, regulations, codes and standards, including, but not limited to:

1. United States Federal Law:

- a. Departments of:

- 1) Commerce, Consolidated Federal Regulations (CFR), Title 15 - Under the Information Technology Management Reform Act (Public Law 104-106), the Secretary of Commerce approves standards and guidelines that are developed by the:

- a) Chapter II, National Institute of Standards Technology (NIST - formerly the National Bureau of Standards). Under Section 5131 of the Information Technology Management Reform Act of 1996 and the Federal Information Security Management Act of 2002 (Public Law 107-347), NIST develops - Federal Information Processing Standards Publication (FIPS) 140-2-Security Requirements for Cryptographic Modules.

- b) Chapter XXIII, National Telecommunications and Information Administration (NTIA - aka 'Red Book') Chapter 7.8 / 9; CFR, Title 47 Federal communications Commission (FCC) Part

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15, Radio Frequency Restriction of Use and Compliance in  
"Safety of Life" Functions & Locations

- 2) FCC - Communications Act of 1934, as amended, CFR, Title 47 - Telecommunications, in addition to Part 15 - Restrictions of use for Part 15 listed Radio Equipment in Safety of Life / Emergency Functions / Equipment/ Locations (also see CFR, Title 15 - Department of Commerce, Chapter XXIII - NTIA):
  - a) Part 15 - Restrictions of use for Part 15 listed Radio Equipment in Safety of Life / Emergency Functions / Equipment/Locations.
  - b) Part 58 - Television Broadcast Service.
  - c) Part 90 - Rules and Regulations, Appendix C.
  - d) Form 854 - Antenna Structure Registration.
  - e) FCC - EN 55103-1&2 - Audio, Video and Entertainment Lighting Control.
- 3) Health, (Public Law 96-88), CFR, Title 42, Chapter IV Health & Human Services, CFR, Title 46, Subpart 1395(a)(b) JCAHO "a hospital that meets JCAHO accreditation is deemed to meet the Medicare conditions of Participation by meeting Federal Directives:"
  - a) All guidelines for Life, Personal and Public Safety; and, Essential and Emergency Communications.
- 4) Labor, CFR, Title 29, Part 1910, Chapter XVII - Occupational Safety and Health Administration (OSHA), Occupational Safety and Health Standard:
  - a) Subpart 7 - Definition and requirements (for a NRTL - 15 c's, for complete list, contact ([http://www.osha.gov/dts/otpca/nrtl/faq\\_nrtl.html](http://www.osha.gov/dts/otpca/nrtl/faq_nrtl.html))):
    - 1) UL:
      - a) 44-02 - Standard for Thermoset-Insulated Wires and Cables.
      - b) 65 - Standard for Wired Cabinets.
      - c) 83-03 - Standard for Thermoplastic-Insulated Wires and Cables.
      - d) 467-01 - Standard for Electrical Grounding and Bonding Equipment
      - e) 468 - Standard for Grounding and Bonding Equipment.

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- f) 486A-01 - Standard for Wire Connectors and Soldering Lugs for Use with Copper Conductors
- g) 486C-02 - Standard for Splicing Wire Connectors.
- h) 486D-02 - Standard for Insulated Wire Connector Systems for Underground Use or in Damp or Wet Locations.
- i) 486E-00 - Standard for Equipment Wiring Terminals for Use with Aluminum and/or Copper Conductors.
- j) 493-01 - Standard for Thermoplastic-Insulated Underground Feeder and Branch Circuit Cable.
- k) 514B-02 - Standard for Fittings for Cable and Conduit.
- l) 1069 - Hospital Signaling and Nurse Call Equipment.
- m) 1333 - Vertical (Riser) Fire Rating.
- n) 1449 - Standard for Transient Voltage Surge Suppressors.
- o) 1479-03 - Standard for Fire Tests of Through-Penetration Fire Stops.
- p) 1863 - Standard for Safety, Communications Circuits Accessories.
- q) 2024 - Standard for Optical Fiber Raceways.
- r) 60950-1/2 - Information Technology Equipment - Safety.
- s) UL6500 - Standard for Audio/Video and Musical Instrument Apparatus for Household, Commercial and Similar General Use
- t) UL 2043 - Standard for Fire Test for Heat and Visible Smoke Release for Discrete Products and Their Accessories Installed in Air-Handling Spaces; 1996
- 2) Canadian Standards Association (CSA): same tests as for UL.
- 3) Communications Certifications Laboratory (CCL): same tests as for UL.
- 4) Intertek Testing Services NA, Inc. (ITSNA formerly Edison Testing Laboratory [ETL]): same tests as for UL.
- b) Subpart 35 - Compliance with NFPA 101 - Life Safety Code.

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- c) Subpart 36 - Design and construction requirements for exit routes.
  - d) Subpart 268 - Telecommunications.
  - e) Subpart 305 - Wiring methods, components, and equipment for general use.
- 5) Department of Transportation, CFR, Title 49 (Public Law 89-670), Part 1, Subpart C - Federal Aviation Administration (FAA):
- a) Standards AC 110/460-ID & AC 707 / 460-2E - Advisory Circulars for Construction of Antenna Towers.
  - b) Forms 7450 and 7460-2 - Antenna Construction Registration.
- 6) Veterans Affairs (Public Law No. 100-527), CFR, Title 38, Volumes I & II:
- a) Office of Telecommunications:
    - 1) Handbook 6100 - Telecommunications.
      - a) Spectrum Management FCC & NTIA Radio Frequency Compliance and Licensing Program.
      - b) Special Communications Proof of Performance Testing, VACO Compliance and Life Safety Certification(s).
  - b) Office of Cyber and Information Security (OCIS):
    - 1) Handbook 6500 - Information Security Program.
    - 2) Wireless and Handheld Device Security Guideline Version 3.2, August 15, 2005.
  - c) VA's National Center for Patient Safety - Veterans Health Administration Warning System, Failure of Medical Alarm Systems using Paging Technology to Notify Clinical Staff, July 2004.
  - d) VA's Center for Engineering Occupational Safety and Health, concurrence with warning identified in VA Directive 7700.
  - e) Office of Construction and Facilities Management (CFM):
    - 1) Master Construction Specifications (PG-18-1).
    - 2) Standard Detail and CAD Standards (PG-18-4).
    - 3) Equipment Guide List (PG-18-5).
    - 4) Electrical Design Manual for VA Facilities (PG 18-10), Articles 7 & 8.

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- 5) Minimum Requirements of A/E Submissions (PG 18-15):
  - a) Volume B, Major New Facilities, Major Additions; and Major Renovations, Article VI, Paragraph B.
  - b) Volume C - Minor and NRM Projects, Article III, Paragraph S.
  - c) Volume E - Request for Proposals Design/Build Projects, Article II, Paragraph F.
- 6) Mission Critical Facilities Design Manual (Final Draft - 2007).
- 7) Life Safety Protected Design Manual (Final Draft - 2007).
- 8) Solicitation for Offerors (SFO) for Lease Based Clinics - (05-2009).
- b. Federal Specifications (Fed. Specs.):
  - 1) A-A-59544-00 - Cable and Wire, Electrical (Power, Fixed Installation).
- 2. United States National Codes:
  - a. American Institute of Architects (AIA): Guidelines for Healthcare Facilities.
  - b. American National Standards Institute/Electronic Industries Association/Telecommunications Industry Association (ANSI/EIA/TIA):
    - 1) 568-C-1 - Commercial Building Telecommunications Wiring Standards:
      - a) C.1 - General Requirements.
      - b) C.2- Balanced twisted-pair cable systems.
      - c) C.3 - Fiber optic cable systems.
    - 2) 569-C - Commercial Building Standard for Telecommunications Pathways and Spaces.
    - 3) 606B - Administration Standard for the Telecommunications Infrastructure of Communications Buildings.
    - 4) 607B - Commercial Building Grounding and Bonding Requirements for Telecommunications.
    - 5) REC 127-49 - Power Supplies.
    - 6) RS 160-51 - Sound systems.
    - 7) RS 270 - Tools, Crimping, Solderless Wiring Devices, Recommended Procedures for User Certification.

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- 8) SE 101-A49 - Amplifier for Sound Equipment.
- 9) SE 103-49 - Speakers for Sound Equipment.
- 10) ANSI S1.4 American National Standard Specification for Sound Level Meters.
- 11) ANSI S1.6 American National Standard Specification for Preferred Frequencies and Band Numbers for Acoustical Measurements.
- 12) ANSI S1.11 American National Standard Specification for Octave-Band and Fractional-Octave-Band Analog and Digital Filters.
- c. American Society of Mechanical Engineers (ASME):
  - 1) Standard 17.4 - Guide for Emergency Personnel.
  - 2) Standard 17.5 - Elevator & Escalator Equipment (prohibition of installing non-elevator equipment in Elevator Equipment Room / Mechanical Penthouse).
- d. American Society of Testing Material (ASTM):
  - 1) D2301-04 - Standard Specification for Vinyl Chloride Plastic Pressure Sensitive Electrical Insulating Tape.
  - 2) ASTM E 1374-02 - Standard Guide for Open Office Acoustics and Applicable ASTM Standards.
  - 3) ASTM E 1573-02 - Standard Test Method for Evaluating Masking Sound in Open Office Using A-Weighted and One-Third Octave Band Sound Pressure Levels.
  - 4) ASTM E 1130-02 - Standard Test Method for Objective Measurement of Speech Privacy in Open Offices Using Articulation Index.
  - 5) ASTM E 1374-93 Standard Guide for Open Office Acoustics and Applicable ASTM Standards.
  - 6) ASTM E1041-85 - Standard Guide for Measurement of Masking Sound in Open Offices.
- e. Building Industries Communications Services Installation (BICSI):
  - 1) All standards for smart building wiring, connections and devices for commercial and medical facilities.
  - 2) Structured Building Cable Topologies.
  - 3) In consort with ANSI/EIA/TIA.

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f. Institute of Electrical and Electronics Engineers (IEEE):

- 1) SO/TR 21730:2007 - Use of mobile wireless communication and computing technology in healthcare facilities - Recommendations for electromagnetic compatibility (management of unintentional electromagnetic interference) with medical devices.
- 2) 0739-5175/08/©2008 IEEE - Medical Grade - Mission Critical - Wireless Networks.
- 3) C62.41 - Surge Voltages in Low-Voltage AC Power Circuits.

g. NFPA:

- 1) 70 - National Electrical Code (current date of issue) - Articles 517, 645 & 800.
- 2) 75 - Standard for Protection of Electronic Computer Data-Processing Equipment.
- 3) 77 - Recommended Practice on Static Electricity.
- 4) 99 - Healthcare Facilities.
- 5) 101 - Life Safety Code.
- 6) 1600 - Disaster Management, Chapter 5.9 - Communications and Warning.

3. State Hospital Code(s).

4. Local Town, City and/or County Codes.

5. Accreditation Organization(s):

- a. Joint Commission on Accreditation of Hospitals Organization (JCAHO) - Section VI, Part 3a - Operating Features.

**1.5 QUALIFICATIONS**

- A. The OEM shall have had experience with three (3) or more installations of systems of comparable size and complexity with regards to type and design as specified herein. Each of these installations shall have performed satisfactorily for at least one (1) year after final acceptance by the user. Include the names, locations and point of contact for these installations as a part of the submittal.
- B. The Contractor shall submit certified documentation that they have been an authorized distributor and service organization for the OEM for a minimum of three (3) years. The Contractor shall be authorized by the OEM to pass thru the OEM's warranty of the installed equipment to VA. In addition, the OEM and Contractor shall accept complete responsibility for the design, installation, certification, operation,

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and physical support for the System. This documentation, along with the System Contractor and OEM certifications must be provided in writing as part of the Contractor's Technical submittal.

- C. The Contractor's Communications Technicians assigned to the System shall be fully trained, qualified, and certified by the OEM on the engineering, installation, operation, and testing of the System. The Contractor shall provide formal written evidence of current OEM certification(s) for the installer(s) as a part of the submittal or to the RE before being allowed to commence work on the System.
- D. The Contractor shall display all applicable national, state and local licenses.
- E. The Contractor shall submit copy (s) of Certificate of successful completion of OEM's installation/training school for installing technicians of the System's PA equipment being proposed.
- F. Manufacturer Qualifications: Minimum of 10 years manufacturing sound masking systems.
- G. System Design: Performed by an approved manufacturer representative.
- H. Installer Qualifications: Approved by manufacturer representative and are trained with the specified products or have demonstrated experience with the installation of similar products to those specified.
- I. System Adjustment: Done by an approved manufacturer representative or trained contractor.
- J. Single Source Responsibility: Source master units, central volume control master units, satellite units, remote controls, and timers from a single manufacturer.
- K. System shall be designed so that individual speaker or component failure will have no impact on the balance of the system.
- L. Security: Central controller must only be accessed via an authorized computer access point. Central controller must be password protected.

**1.6 CODES AND PERMITS**

- A. Provide all necessary permits and schedule all inspections as identified in the contract's milestone chart, so that the system is proof of performance tested and ready for operation on a date directed by the Resident Engineer.
- B. The contractor is responsible to adhere to all codes described herein and associated contractual, state and local codes.



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- C. The Contractor shall display all applicable national, state and local licenses and permits.

**1.7 SCHEDULING**

- A. After the award of contract, the Contractor shall prepare a detailed schedule (aka milestone chart) using "Microsoft Project" software or equivalent. The Contractor Project Schedule (CPS) shall indicate detailed activities for the projected life of the project. The CPS shall consist of detailed activities and their restraining relationships. It will also detail manpower usage throughout the project.
- B. It is the responsibility of the Contractor to coordinate all work with the other trades for scheduling, rough-in, and finishing all work specified. The VAMC will not be liable for any additional costs due to missed dates or poor coordination of the supplying contractor with other trades.

**1.8 REVIEW OF CONTRACT DRAWINGS AND EQUIPMENT DATA SUBMITTALS**

(Note: The Contractor is encouraged, but not required, to submit separate technical submittal(s) outlining alternate technical approach(s) to the system requirements stated here-in as long as each alternate technical document(s) is complete, separate, and submitted in precisely the same manner as outlined herein. VA will review and rate each received alternate submittal, which follows this requirement, in exactly the same procedure as outlined herein. Partial, add-on, or addenda type alternates will not be accepted or reviewed.)

- A. Submit at one time within 10 days of contract awarding, drawings and product data on all proposed equipment and system. Check for compliance with contract documents and certify compliance with Contractor's "APPROVED" stamp and signature.
- B. Support all submittals with descriptive materials, i.e., catalog sheets, product data sheets, diagrams, and charts published by the manufacturer. These materials shall show conformance to specification and drawing requirements.
- C. Where multiple products are listed on a single cut-sheet, circle or highlight the one that you propose to use. Provide a complete and through equipment list of equipment expected to be installed in the system, with spares, as a part of the submittal. Special

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Communications (TVE-0050P3B) will not review any submittal that does not have this list.

- D. Provide four (4) copies to the PM for technical review. The PM will provide a copy to the offices identified in Paragraph 1.3.C & D, at a minimum for compliance review as described herein where each responsible individual(s) shall respond to the PM within 10 days of receipt of their acceptance or rejection of the submittal(s).
- E. Provide interconnection methods, conduit (where not already installed), junction boxes (J-Boxes), cable, interface fixtures and equipment lists for the: Head End Room (HER), Head End Cabinet (HEC), Head End Interface Cabinet (HEIC) and approved TCO locations Telecommunications Infrastructure Plant (TIP) interface distribution layout drawing, as they are to be installed and interconnected to each other (REFER TO APPENDIX B - SUGGESTED TELECOMMUNICATIONS ONE LINE TOPOLOGY pull-out drawing).
- F. Headend and each interface distribution cabinet layout drawing, as they are expected to be installed.
- G. Equipment OEM technical literature detailing the electrical and technical characteristics of each item of equipment to be furnished.
- H. Engineering drawings of the System, showing calculated or expected signal levels at the headend input and output, each input and output distribution point, and signal level at each telecommunications outlet.
- I. Surveys Required as a Part of The Technical Submittal:
  - 1. The Contractor shall provide the following System survey(s) that depict various system features and capacities required in addition to the on-site survey requirements described herein. Each survey shall be in writing and contain the following information (the formats are suggestions and may be used for the initial Technical Submittal Survey requirements), as a minimum:
    - a. PA Cable System Design Plan:
      - 1) An OEM and contractor designed functioning PA System cable plan to populate the entire TIP empty conduit/pathway distribution systems provided as a part of Specification 27 11 00 shall be provided as a part of the technical proposal. A specific functioning PA: cable, interfaces, J-boxes and back boxes shall coincide with the total growth items as described herein. It is the Contractor's responsibility to provide the

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Systems' entire PA cable and accessory requirements and engineer a functioning PA distribution system and equipment requirement plan of the following paragraph(s), at a minimum:

2) The required PA Equipment Locations:

<u>EQUIPPED ITEM</u>	<u>CAPACITY</u>	<u>GROWTH</u>
Master Control Stations		
Zone Amplifiers		
All Call (complete Zone)		
Clinics (Zone)		
Corridors (Zone)		
Spare (Zones)		5%
Speakers		
Overhead		5%
Power Supply(s)		
Location		
UPS(s)		
Location		10%
Maintenance/Programming Console		
Location(s)		

3) The required PA Cable Plant/Connections:

The Contractor shall clearly and fully indicate this category for each item identified herein as a part of the technical submittal. For this purpose, the following definitions and sample connections are provided to detail the system's capability:

<u>EQUIPPED ITEM</u>	<u>CAPACITY</u>	<u>GROWTH</u>
Central Control Cabinet/Equipment		
Location		
Power Supply(s)		
UPS(s)		
Essential Electrical Power Panel(s)		
Other		
Cable Plant		
Supply to Locations Identified		

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<u>EQUIPPED ITEM</u>	<u>CAPACITY</u>	<u>GROWTH</u>
herein		
Speaker Locations		
Maintenance/Program Console		
Location(s)		
Other		

- J. Product Data: Manufacturer's specifications and installation instructions.
- K. Submit manufacturer's data or shop drawings of the following apparatus, giving full information as to dimensions, materials, and all information pertinent to adequacy of submitted equipment:
1. Masking Sound Speakers.
  2. Additional necessary masking equipment needed.
  3. Wire.
  4. Power supply.
  5. Paging/Music Equipment.
  6. Paging Only Speakers.
  7. Programmable Timers.
  8. All Head-End Equipment.
  9. Network Equipment.
- L. Shop Drawings: Prepare and submit detailed dimensioned shop drawings for conduit runs (if required) and other distribution services including elevations showing minimum clearances and installed features and devices for system components. Show types and locations of masking speakers and their wiring connections. Channel assignments, and axis orientations. Show ducts, beams; and other significant sound reflecting and absorbing elements in ceiling space and show locations of partitions below ceiling. Include a diagram showing interconnection of major system components for each zone and channel and indicating grounding connections.
- M. Each shop drawing shall contain job title and reference(s) to the applicable drawing(s) and/or specification article(s).
- N. Product Certificates: Signed by manufacturers of sound masking equipment and components certifying that products furnished comply with requirements.

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- O. Maintenance Data: For sound masking equipment and components (if needed) to include in maintenance manuals specified in Division 01. Include data for each type of product, including all features and operating sequences; both automatic and manual.
- P. System Design: Schematics of the system showing quantity and location of system components and related cabling and accessories.
- Q. Equipment operation and service maintenance manuals shall be provided for the equipment employed in the systems. This shall include wiring diagrams. The information in the manuals and on the drawings shall be sufficiently detailed to allow a technician of normal competence to understand, install, operate, maintain, calibrate, and repair the equipment.
- R. Warranty Documents: Warranty documents covering the system components.

**1.9 PROJECT RECORD DOCUMENTS (AS BUILTS)**

- A. Throughout progress of the Work, maintain an accurate record of changes in Contract Documents. Upon completion of Work, transfer recorded changes to a set of Project Record Documents.
- B. The floor plans shall be marked in pen to include the following:
  - 1. All device locations with UL labels affixed.
  - 2. Conduit locations.
  - 3. Head-end equipment and specific location.
  - 4. Each interface and equipment specific location.
  - 5. Telecommunication Outlet (s -TCO) equipment and specific location
  - 6. TIP Wiring diagram(s).
  - 7. Warranty certificate.
  - 8. System test results.
  - 9. System Completion Document(s) or MOU.
- C. Record of Final Field Tests and Measurements: Include final adjustment of system.

**1.10 WARRANTIES / GUARANTY**

- A. The Contractor shall warrant the installation to be free from defect in material and workmanship for a period of two (2) years from the date of acceptance of the project by the VAMC. The Contractor shall agree to remedy covered defects within four (4) hours of notification of major failures or within twenty-four (24) hours of notification for individual station related problems.

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- B. The Contractor shall agree to grantee the system according to the guidelines outlined in Article 4 herein.
- C. At project closeout, provide to Resident Engineer, an executed copy of the manufacturer's standard limited warranty against manufacturing defect, outlining its terms, conditions, and exclusions from coverage.
- D. The Sound Masking / Paging System shall be warranted to be free from defects in materials, workmanship, and performance for 10 years from date of installation.

**1.11 USE OF THE SITE**

- A. Use of the site shall be at the GC's direction.
- B. Coordinate with the GC for lay-down areas for product storage and administration areas.
- C. Coordinate work with the GC and their sub-contractors.
- D. Access to buildings wherein the work is performed shall be directed by the GC.

**1.12 DELIVERY, STORAGE, AND HANDLING**

- A. Deliver, store, and handle products using means and methods that will prevent damage, deterioration, and loss, including theft.
- B. Store products in original containers.
- C. Coordinate with the GC for product storage. There may be little or no storage space available on site. Plan to potentially store materials off site.
- D. Do not install damaged products. Remove damaged products from the site and replaced with new product at no cost to the VAMC.
- E. Protect from moisture during shipping, storage, and handling.
- F. Deliver in manufacturer's original unopened and undamaged packages with manufacturer's labels intact.
- G. Inspect manufacturer's packages upon receipt.
- H. Handle packages carefully.
- I. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's absolute limits.

**1.13 PROJECT CLOSE-OUT**

- A. Prior to final inspection and acceptance of the work, remove all debris, rubbish, waste material, tools, construction equipment,

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machinery and surplus materials from the project site and thoroughly clean your work area.

- B. Before the project closeout date, the Contractor shall submit:
  - 1. Warranty certificate.
  - 2. Evidence of compliance with requirements of governing authorities such as the Low Voltage Certificate of Inspection.
  - 3. Project record documents.
  - 4. Instruction manuals and software that is a part of the system.
- C. Contractor shall submit written notice that:
  - 1. Contract Documents have been reviewed.
  - 2. Project has been inspected for compliance with contract.
  - 3. Work has been completed in accordance with the contract.

**PART 2 - PRODUCTS / FUNCTIONAL REQUIREMENTS**

**2.0 GENERAL REQUIREMENTS FOR EQUIPMENT AND MATERIALS**

- A. Furnish and install a complete and fully functional and operable Sound Masking PUBLIC ADDRESS AND MASS NOTIFICATION System for each location shown on the contract drawings and TCOs WHOSE EMPTY CONDUIT SYSTEM WAS PROVIDED AS A PART OF SPECIFICATION 27 11 00.
- B. The specific location for each PA: Central Control Cabinet is 9122C, Power Supply is 9024W 9052N and 9083S, Electrical Supervisor Panel is 9024W 9052N and 9083S, UPS is 9024W 9052N and 9083S, Main Equipment Cabinet is 2110GA.
- C. Coordinate features and select interface components to form an integrated Sound Masking PUBLIC ADDRESS AND MASS NOTIFICATION SYSTEMS system. Match components and interconnections between the systems for optimum performance of specified functions.
- D. Expansion Capability: The PA equipment interfaces and cables shall be able to increase number of enunciation points in the future by a minimum of 50 percent (%) above those indicated without adding any internal or external components or main trunk cable conductors.
- E. Equipment: Active electronic type shall use solid-state components, fully rated for continuous duty unless otherwise indicated. Select equipment for normal operation on input power usually supplied between 110 to 130 VAC, 60 Hz.
- F. Meet all FCC requirements regarding low radiation and/or interference of RF signal(s). The system shall be designed to prevent direct pickup of signals from within and outside the building structure.

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- G. Deliver a fully functioning and operable PA in the specific locations shown on the drawings.
- H. All masking/paging units must be UL Listed for use in a ceiling plenum.
- I. The system must be manufactured in the USA.
- J. All equipment and associated hardware shall be fabricated and installed in accordance with the manufacturer's specified recommendations.
- K. All wiring for power shall be minimum 16 gauge.
- L. All wiring for Audio and Data shall be CAT 6, 4 pair, with RJ45 connectors.
- M. Location of grounding points shall be determined carefully to insure minimizing of system hum and elimination of ground loops. In addition, all connections of shields and conductors to equipment shall be in accordance with manufacturer's instructions and best professional practices.
- N. In open areas and larger enclosed spaces, the overall sound level produced should have spacial uniformity of no more than  $\pm 1/2$  dB between any two sound generating units.
- O. The sound generating units must have an adjustable sound spectrum shaping control in order to meet the varying spectral requirements of drywall ceilings; various types of ceiling tile, air return grills and openings around lighting fixtures, etc. The following is required:
  - 1. The spectrum shaping ability shall be variable within the accepted background sound masking range (acoustical preferred curve).
  - 2. Noise masking outputs are able to be shaped with a 1/3 band octave equalizer.
  - 3. Noise masking outputs are able to be shaped with a minimum 30 band parametric equalizer.
  - 4. Equalizers will be able to manipulate the entire audio spectrum from 25 Hz to 20 KHz.
  - 5. System must be capable of providing sound masking volume increments in 1/2 dB steps.
  - 6. The system shall be capable of producing the sound spectrum and levels as specified in Section 3.7 of these same specifications.
- P. Spatial Uniformity (Directional Effect): People in masked space under normal operating conditions cannot determine source of masking sound.
- Q. Temporal Uniformity: One minute time-averaged sound pressure level of any octave band of masking sound from 250 to 8000 Hz remains constant



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in any space to within a standard deviation of 2 dB when measured over a 30-minute period.

- R. Sound Quality: No audible hum or noise, other than masking noise, from this system in masked spaces should be detected.

**2.1 SYSTEM DESCRIPTION**

- A. Furnish and install a complete and fully functional and operable Sound Masking PUBLIC ADDRESS AND MASS NOTIFICATION SYSTEMS. Provide additional require conduit(s) according to Specification 27 11 00.
- B. The Contractor shall continually employ interfacing methods that are approved by the OEM and VA. At a minimum, an acceptable interfacing method requires not only a physical and mechanical connection, but also a matching of signal, voltage, and processing levels with regard to signal quality and impedance. The total PA system shall be configured and installed so that the combination of equipment actually employed does not produce any undesirable visual or aural effects such as signal distortions, noise pulses, glitches, hum, transients, images, etc. The interface points must adhere to all standards described herein for the full separation of Critical Care and Life Safety systems.
- C. It is not acceptable to utilize the telephone cable system for the control of radio signals and equipment. The System Contractor shall connect the Telephone System Remote Control System to the Radio System Paging Control Unit ensuring that all NFPA and UL Critical Care and Life Safety Circuit and System separation guidelines are satisfied. The System Contractor is not allowed to make any connections to the Telephone System. The Resident Engineer shall arrange for the interconnection between the PA and Telephone Systems with the appropriate responsible parties.
- D. System hardware shall consist of a *standalone (separate)* PA communications network comprised of amplifiers, mixers, speakers, volume controls, test sets, telephone private branch exchange (PBX) interface equipment, equipment cabinets/racks, wiring and other options such as, sub zoning in addition to "all call" functions, computer interfaces, and printer interfaces and as shown on drawings. All necessary equipment required to meet the intent of these specifications, whether or not enumerated within these specifications, shall be supplied and installed to provide a complete and operating nurse/patient communications network.

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- E. Systems firmware shall be the product of a reputable firmware OEM of record with a proven history of product reliability and sole control over all source code. Manufacturer shall provide, free of charge, product firmware/software upgrades for a period of two (2) years from date of acceptance by VA for any product feature enhancements. System configuration programming changes shall not require any exchange of parts and shall be capable of being executed remotely via a modem connection (when specifically approved first by 0050P3B).
- F. The PA Head End Equipment shall be located in Telecommunications Rooms 9024W, 9052N, and 9083S. The PA shall cover Floor Nine. The PA shall provide zoned, one-way voice paging through distributed, ceiling mounted loudspeakers. Voice input into the PA shall be by zone using the telephone system.
- G. The System shall utilize microprocessor components for all signaling and programming circuits and functions. Self-contained or on board system program memory shall be non-volatile and protected from erasure from power outages for a minimum of 24 hours.
- H. Provide a backup battery or a UPS for the System (including each distribution cabinet/point, CRT, LCD and Monitor) to allow normal operation and function (as if there was no AC power failure) in the event of an AC power failure or during input power fluctuations for a minimum of two (2) Hours.
- I. The System is defined as Emergency Service and the Code Blue functions is defined as Life Safety/Support by NFPA (re Part 1.1.A) and so evaluated by JCAHCO. Therefore, the system shall have a minimum of two (2) additional remote enunciation points in order to satisfy NFPA's Life Safety Code 101 where each enunciation point shall fully function independent of the Facility's PBX.
  - 1. These two (2) additional remote locations shall be fully manned:
    - a. 24/7/365 for certified Hospital **Clinics**.
    - b. As long as other identified VA Medical / Servicing Facilities are open for servicing patients.
    - c. The minimum remote enunciation locations shall be:
      - 1) The Telephone / PBX Operator Room.
      - 2) The Police Control / Operations Room.

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- 3) Other location(s) that is specifically approved by VA Headquarters TVE - 0050P3B DURING THE PROJECT DEVELOPMENT STAGES AND PRIOR TO EQUIPMENT PURCHASE.
- d. One (1) global (aka "all call") hard wired zone shall be provided that connects to every system speaker.
- e. There shall be 37 hard-wired sub-zones designated as follows:
  - 1) North Wing.
  - 2) South Wing.
  - 3) West Wing.
  - 4) Each zone shall be capable of be programmed.
  - 7) The System shall have a minimum of three (3), unused zones.
- 2. The System shall allow voice pages to be made within a single zone, across programmed multiple zones or a global page (all zones) by using preset codes entered into the keypad of any telephone instrument attached to the PBX.
- J. The System shall interface with the Facility's existing PAS so that a global page (aka "all call" page) is communicated to the existing PAS and the new System of this project. Arrangements for interconnection of the System and the telephone system(s) shall be coordinated with the Resident Engineer and the PBX provider.
- K. The system shall be designed to provide continuous electrical supervision of the complete and entire system (i.e. light bulbs, wires, contact switch connections, master control stations, wall stations, circuit boards, data, audio, and communication busses, main and UPS power, etc.). All alarm initiating and signaling circuits shall be supervised for open circuits, short circuits, and system grounds. Main and UPS power circuits shall be supervised for a change in state (i.e. primary to backup, low battery, UPS on line, etc.). When an open, short or ground occurs in any system circuit, an audible and visual fault alarm signal shall be initiated at the main supervisory panel, nurse control station and all remote amplifier locations.

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- L. When the System is approved to connect to a separate communications system (i.e. LAN, WAN, Telephone, Nurse Call, radio raging, wireless systems, etc) the connection point shall be at one location and shall meet the following minimum requirements for each hard wired connection (note each wireless system connection MUST BE APPROVED PRIOR TO CONTRACT BID BY VA HEADQUARTERS 0050P3B AND 0050P2B):
1. UL 60950-1/2.
  2. FIPS 142.
  3. FCC Part 15 Listed Radio Equipment is not allowed.
- M. All passive distribution equipment shall meet or exceed -80 dB radiation shielding (aka RFI) shielding specifications and be provided with screw type audio connectors.
- N. All equipment face plates utilized in the system shall be stainless steel, anodized aluminum or UL approved cyclac plastic for the areas where provided.
- O. All trunk, branch, and interconnecting cables and unused equipment ports or taps shall be terminated with proper terminating resistors designed for RF, audio and digital cable systems without adapters.
- P. Noise filters and surge protectors shall be provided for each equipment interface cabinet, headend cabinet, control console and local and remote amplifier locations to insure protection from input primary AC power surges and to insure noise glitches are not induced into low voltage data circuits.
- Q. Plug-in connectors shall be provided to connect all equipment, except coaxial cables and RF transmission line interface points. Coaxial cable distribution points and RF transmission lines shall use coaxial cable connections recommended by the cable OEM and approved by the system OEM. Base band cable systems shall utilize barrier terminal screw type connectors, at a minimum. As an alternate, crimp type connectors installed with a ratchet type installation tool are acceptable provided the cable dress, pairs, shielding, grounding, connections and labeling are the same as the barrier terminal strip connectors. Tape of any type, wire nuts or solder type connections are unacceptable and will not be approved.

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- R. Audio Level Processing: The control equipment shall consist of audio mixer(s), volume limiter(s) and/or compressor(s), and power amplifier(s) to process, adjust, equalize, isolate, filter, and amplify each audio channel for each sub-zone in the system and distribute them into the System's RF interfacing distribution trunks and amplification circuits. It is acceptable to use identified Telephone System cable pairs designated for Two-Way Radio interface and control use or identified as spare telephone cable pairs by the Facility's Telephone System Contractor. The use of telephone cable to distribute RF signals, carrying system or sub-system AC or DC voltage is not acceptable and will not be approved. Additionally, each control location shall be provided with the equipment required to insure the system can produce its designed audio channel capacity at each speaker identified on the contract drawings. The Contractor shall provide: a spare set of telephone paging modules as recommended by the OEM (as a minimum provide one spare module for each installed module); one spare audio power amplifier, one spare audio mixer, one spare audio volume limiter and/or compressor, and one spare audio automatic gain adjusting device, and minimum RF equipment recommended by the OEM.
- S. Contractor is responsible for pricing all accessories and miscellaneous equipment required to form a complete and operating system. Unless otherwise noted in this Part, equipment quantities shall be as indicated on the drawings.
- T. System must be capable of performing a complete diagnostics of its entire functions including diagnostics of the network, hubs, nodes, routers, dsp's, memory, circuitry, amplifiers, and power.
- U. System must be capable of reporting entire settings for each zone for masking, paging, and music indicating at a minimum the volume, contour, 1/3 band octave equalization, parametric equalization, diagnostics, and groupings.
- V. System must be capable of reporting, via e-mail, in real time, any compromised digital network connection.

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**2.2 SYSTEM PERFORMANCE**

- A. At a minimum, each distribution, interconnection, interface, terminating point and TCO shall be capable of supporting the Facility's PA system voice and data service as follows:
1. Shall be compliant with and not degrade the operating parameters of the Public Switched Telephone Network (PSTN) and the Federal Telecommunications System (FTS) at each PSTN and FTS interface, interconnection and terminating locations in the TERs.
  2. Audio Input: The signal level of each audio input channel at each input point shall be a MINIMUM of zero decibels measured (dBm), +0.10 dBm across 150 Ohms, balanced.
  3. Audio Output: The audio signal level at each speaker shall be a MINIMUM of +0.25 Watt (W) and a maximum of +20 W, 600 Ohms balanced impedance, on a 70.7 V audio distribution line Contractor to determine and set each speaker's proper audio signal level (top) based on speaker location and the ambient noise level in speaker coverage area.
  4. The system shall meet the following MINIMUM parameters at each speaker:
    - a. Cross Modulation: -46 dB
    - b. Hum Modulation: -55 dB
    - c. Isolation (outlet-outlet): 24 dB
    - d. Impedance:
      - 1) Distribution: 600 Ohm balanced @ 70.7 V audio line level.
      - 2) Speaker: Selectable, as required.
    - e. Audio Gain: 10 dB minimum @ mid-range measured with a sound pressure level meter (SPL)
    - f. Signal to noise (S/N) ratio: 35 dB, minimum

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B. Audio Level Processing: The head-end equipment shall consist of audio mixer(s), volume limiter(s) and/or compressor(s), and power amplifier(s) to process, adjust, equalize, isolate, filter, and amplify each audio channel for each zone or sub-zone in the system and distribute them into the system's distribution trunks. It is acceptable to use identified telephone system cable pairs designated for PA use or identified as spare telephone cable pairs by the Facility's Telephone System Contractor.

1. THE USE OF TELEPHONE CABLE TO DISTRIBUTE PA SIGNALS CARRYING AC OR DC VOLTAGE IS NOT ACCEPTABLE AND WILL NOT BE APPROVED.
2. Additionally, each remote location shall be provided with the equipment required to ensure the system supervision and designed audio channel capacity at each speaker identified on the contract drawings.

**2.3 PERFORMANCE REQUIREMENTS**

- A. The Sound Masking / Paging system must use one control unit for the entire system. Multiple control units are NOT acceptable.
- B. The Sound Masking / Paging system must contain an integrated sound masking and paging digital signal processors (DSP's) system that utilizes an open platform network technology with web appliances, browser interfaces, infrared remote controls and internet access capable.
- C. The Sound Masking / Paging system must be capable of separately and independently configuring zones for sound masking, paging and music via the network zoned through its singular central control.
- D. The Sound Masking system must produce a masking noise from 20Hz through 20,000Hz at its source.
- E. The Sound Masking must be random and provide a minimum pattern of no LESS than 24 hours.
- F. The Sound Masking system must provide both a 1/3 octave band equalizer for a minimum of 30 bands and a parametric equalizer to adjust the sound masking.
- G. The Sound Masking / Paging system must provide global muting function through dry contact closure for fire alarms.
- H. The Sound Masking / Paging system must provide automatic Adaptive Equalization to ensure a flat response for the entire building for paging.

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- I. The Sound Masking / Paging system must provide zone overlap where each speaker channel has a minimum of 10 programmable zones for masking, paging and music separately.
- J. The Sound Masking / Paging system must meet ANSI 709.1 / ISO / IEC standards for open platform.
- K. The Sound Masking / Paging system must meet the US Army Corp.'s Unified Facilities Guide Specifications, UFGS 25 10 10, "Utilities Monitoring and Control System" and UFGS 23 09 23, "Direct Digital Control for HVAC and Other Local Building Controls".
- L. The Sound Masking / Paging equipment must have individual LCD identifiers.
- M. Plenum mounted network locations must have a lighted LED for visual inspection.
- N. The Sound Masking / Paging system must be a multi-drop network system. Point to point systems are unacceptable.
- O. The Sound Masking / Paging system must be capable of being tuned through a network and a hand-held remote.
- P. The Sound Masking / Paging system must be capable of performing diagnostic functions.
- Q. The Sound Masking / Paging system must be capable of reporting entire settings for each zone for masking, paging and music indicating at a minimum the volume, contour, 1/3rd band octave equalization, parametric equalization, diagnostics, and groupings.
- R. The Sound Masking / Paging system must be an open platform system. Proprietary software systems are unacceptable.
- S. The Sound Masking / Paging system must be capable of performing a complete diagnostics of its entire functions including diagnostics of the network, hubs, nodes, routers, dsp's, memory, circuitry, amplifiers and power.
- T. The Sound Masking / Paging system must be capable of using diagnostics and remote administration via a standard web browser.
- U. The Sound Masking / Paging must be able to use upward facing and downward facing speaker and horn speakers.
- V. The Sound Masking/ Paging must only use speakers with diameters larger than 4" but not to exceed 6-1/2".



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**2.4 MANUFACTURERS**

- A. The products specified shall be new, FCC and UL Listed, labeled and produced by OEM of record. An OEM of record shall be defined as a company whose main occupation is the manufacture for sale of the items of equipment supplied and which:
  - 1. Maintains a stock of replacement parts for the item submitted,
  - 2. Maintains engineering drawings, specifications, and operating manuals for the items submitted, and
  - 3. Has published and distributed descriptive literature and equipment specifications on the items of equipment submitted at least 30 days prior to the Invitation for Bid (IFB).
- B. Specifications contained herein as set forth in this document detail the salient operating and performance characteristics of equipment in order for VA to distinguish acceptable items of equipment from unacceptable items of equipment. When an item of equipment is offered or furnished for which there is a specification contained herein, the item of equipment offered or furnished shall meet or exceed the specification for that item of equipment.
- C. Equipment Standards and Testing:
  - 1. The System has been defined herein as connected to systems identified as an Emergency performing Public Safety Support Functions. Therefore, at a minimum, the system shall conform to all aforementioned National and/or Local Public and Life Safety Codes (which ever are the more stringent), NFPA, NEC, this specification, JCAHCO Life Safety Accreditation requirements, and the OEM recommendations, instructions, and guidelines.
  - 2. All supplies and materials shall be listed, labeled or certified by UL or a nationally recognized testing laboratory (NRTL) where such standards have been established for the supplies, materials or equipment.
  - 3. The provided equipment required by the System design and approved technical submittal must conform with each UL standard in effect for the equipment, as of the date of the technical submittal (or the date when the RE approved system equipment necessary to be replaced) was technically reviewed and approved by VA. Where a UL standard is in existence for equipment to be used in completion of this contract, the equipment must bear the approved UL seal.

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4. Each item of electronic equipment to be provided under this contract must bear the approved UL seal or the seal of the testing laboratory that warrants the equipment has been tested in accordance with, and conforms to the specified standards. The placement of the UL Seal shall be a permanent part of the electronic equipment that is not capable of being transportable from one equipment item to another.

**D. Manufacturers: Basis of design shall be:**

Lencore Acoustics Corp.  
1 Crossways Park Drive W  
Woodbury, NY 11797  
PH: 516-682-9292  
FX: 516-682-4785  
Website: [www.lencore.com](http://www.lencore.com)  
Email: [drawings@lencore.com](mailto:drawings@lencore.com)

Or subject to compliance with all requirements and approval by Engineer and Resident Engineer, provide equal products by the following:

1. **Cambridge Sound Management**
2. **Equal**

**2.5 PRODUCTS**

**A. General:**

1. Contractor is responsible for pricing all accessories and miscellaneous equipment required to form a complete and operating system. The equipment quantities provided herein shall be as indicated on the drawings with the exception of the indicated spare equipment.
2. Each cabinet shall be provided with internal and external items to maintain a neat and orderly system of equipment, wire, cable and conduit connections and routing.
3. Contractor Furnished Equipment List (CFEs):
  - a. The Contractor is required to provide a list of the CFE equipment to be furnished. The quantity, make and model number of each item is required. Select the required equipment items quantities that will satisfy the needs of the system as described herein and with the OEM's concurrence applied to the list(s), in writing.
  - b. The following equipment items are the minimum requirements of VA to provide an acceptable system described herein:

<u>Item</u>	<u>Quantity</u>	<u>Unit</u>
1. As required	Interface Panel(s)	
1.a As required	Electrical Supervision	

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		Trouble Enunciator
1.a.1.	As required	Equipment Back Box(s)
1.a.2.	0	Telephone Access Equipment
2.	As required	Lightning Arrestor
3.	As required	Head End Equipment Locations
3.a	As required	Cabinet(s)
3.a.1.	As required	AC Power Conditioner & Filter
3.a.2.	As required	AC Power Strip
3.a.3.	As required	UPS
3.a.3.a	As required	Main Power Amplifiers
3.a.3.b	As required	Remote Power Amplifiers
3.a.3.c	As required	Distributed Amplifiers (When Approved)
3.a.4.	As required	Interconnecting wire Cable(s)
3.a.4.a	As required	Wire Cable Connector(s)
3.a.4.b	As required	Wire Cable Terminator(s)
3.a.4.c	As required	Wire Management System
3.b.	As required	Head End Function(s)
4.	As required	Distribution System(s)
4.a	As required	Equipment Back Box(s)
4.a.1.	As required	Speakers
4.a.1.a	As required	Overhead
4.a.1.b	0	Horn
5.	2 (MIN)	Remote Station(s)
5.a.	As required	Spare Items

**B. ENT (aka DEMARC) Room(s):**

Refer to CFM Physical Security Manual (07-2007) for VA Facilities,  
 Chapters 9.3 & 1) and PG 18-10, EDM, Chapters 7- Table 7-1, 8 &  
 Appendix B, Telecommunications One Line Topology for specific Room and  
 TIP Connection Requirements.

**C. TER, TCR, TR, SCC, PCR, STR, HER Rooms and Equipment:**

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Refer to CFM Physical Security Manual (07-2007) for VA Facilities, Chapters 9.3 & 1) and PG 18-10, EDM, Chapters 7- Table 7-1, 8 & Appendix B, Telecommunications One Line Topology for specific Room and TIP Connection Requirements.

1. Interface Equipment:

a. TER:

1) Paging adaptor:

a) The Contractor shall coordinate the installation of the paging adapter(s) designed for use with the Facility's telephone system with the Facility Telephone Contractor or local telephone company.

b) The Contractor shall provide and install a paging adapter(s) for each zone and sub zone. The paging adapter(s) shall be accessible by dialing a telephone number provided by the Facility's Telephone Contractor. The Paging Adapter shall:

- 1) Monitor each audio input and output on the unit.
- 2) Be provided with an electrical supervision panel to provide both audio and visual trouble alarms.
- 3) Be provided as part of the head end equipment and shall be located in the Telephone Switch Room
- 4) Be provided with Executive (aka emergency) Paging Override of all routine paging calls in progress or being accessed to allow system "all call" (aka global) and radio paging calls designated as (Code One Blue) functions.
- 5) Be capable of internal time out capability.
- 6) Function completely with the interface module.
- 7) Provide one spare adapter.

c) Time Out Device: A time out device/capability shall be provided to prevent system "hang-up" due to an off-hook telephone. The device shall be able to be preset from 30 seconds to two (2) minutes. Its function shall not interfere with or override the required "all call" (aka global) operational capability.

1) Central Processor Module:

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- 2) Controls system operations and holds all programmed parameters.
- 3) Data link connection to additional CPU modules.
- d) Power Module: Provides 12V DC @ 800mA to Central Processor Module.
- e) Minimum three (3) Zone Module:
  - 1) Provides a minimum of three (3) paging zone outputs at 70V audio sound level.
  - 2) Background Music inhibit switch for each zone.
- 2) Audio Monitor Panel:
  - a) The panel shall be EIA/TIA standard for 483 mm (19") cabinet mounting.
  - b) It shall be provided in the upper portion of the head-end equipment cabinet.
  - c) Provide one (1) spare panel.
- 3) Trouble Annunciator Panel:
  - a) A trouble annunciator panel shall be provided in the head-end cabinet, and at locations as designated on the contract drawings. The panel(s) shall be compatible with or generate electrical and/or electronic supervising signals to continuously monitor the operating condition for the System head-end audio power amplifier(s), remote power amplifier(s), microphone consoles and interconnecting trunks. The panels shall generate an audible and visual signal when the System's supervising system detects an amplifier or trunk-line is malfunctioning.
  - b) Provide one (1) spare panel.
- 4) Head-End Equipment
  - a) Provide all required power supplies, communications hubs, network switches, intelligent controllers and other devices necessary to form a complete system listed herein. Head-end components may be rack mounted or wall mounted in a metal enclosure.
  - b) Provide the head end equipment in the closed telecommunications closet where the PA system is installed to include the minimum equipment listed herein.

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- c) Provide minimum of 30 minute battery back-up to system components.
- 5) Equipment Cabinet: Comply with TIA/EIA-310-D. Lockable, ventilated metal cabinet houses terminal strips, power supplies, amplifiers, system volume control, and other switching and control devices required for conversation channels and control functions
  - a) Vertical Equipment Rack, Wall Mounted (to be included inside of the Equipment Cabinet):
  - b) 74" (48RU) rack space, Welded Steel construction, Minimum 20" usable depth, Adjustable front mounting rails.
    - 1) Install the following products in rack provided by same manufacturer or as specified:
    - 2) Security screws w/ nylon isolation bushings.
    - 3) Textured blank panels.
    - 4) Custom mounts for components without rack mount kits.
    - 5) Security covers.
    - 6) Copper Bus Bar.
    - 7) Power Sequencer rack mounted power conditioner and (provide as needed) delayed sequencer(s) with two (2) inswitched outlets each and contact closure control inputs.
    - 8) Rack mounting: Provide rack mount kit.
- 6) Amplifier Equipment:
  - a) Paging (aka zone):
    - 1) Inputs for 600-ohm balanced telephone line, LO-Z balanced microphone, and background music.
    - 2) Input Sensitivity: Compatible with master stations and central equipment so amplifier delivers full rated output with sound-pressure level of less than 10 dynes/sq. cm impinging on master stations speaker microphones, or handset transmitters
    - 3) Automatic Level Control (ALC) for pages, adjustable background music muting level during page, wall or rack mountable.
    - 4) 16-ohm, 25V, 25V center tapped (CT), and 70V outputs. Amplifier quantity and size (output power) as needed.

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Continuous amplifier power rating shall exceed  
loudspeaker load on amplifier by at least 25%.

- 5) Output Power: 70-V balanced line. 80 percent of the sum of wattage settings of connected for each station and speaker connected in all-call mode of operation, plus an allowance for future stations.
  - 6) Total Harmonic Distortion: Less than 5 percent at rated output power with load equivalent to quantity of stations connected in all-call mode of operation.
  - 7) Minimum Signal-to-Noise Ratio: 45 dB, at rated output.
  - 8) Frequency Response: Within plus or minus 3 dB from 70 to 12,000 Hz.
  - b) Output Regulation: Maintains output level within 2 dB from full to no load.
  - c) Amplifier Protection: Prevents damage from shorted or open output.
  - d) Be provided with electronic supervision function(s).
  - e) Provide one spare amplifier.
- b. TCR:
- 1) Microphone Paging Console:
    - a) A console shall be provided in the TCR and PCR's as shown on the drawings.
    - b) The console shall contain visual enunciators for each connection to the telephone system's Public Address Paging Adapter. The visual enunciators shall display all the System connections to the telephone system being used.
    - c) The console shall be fully independent of the Facility's telephone system so if the telephone system has a catastrophic failure (aka partial, multiple or total system failure) the microphone console will function normally as if the Facility's telephone system was operating normally. The restoration of the Facility's telephone system shall not affect the System.
    - d) Each microphone console shall:
      - 1) Be Mounted: Flush unless otherwise indicated, and suitable for mounting conditions indicated.

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- 2) Have a Faceplate: Stainless steel or anodized aluminum with tamperproof mounting screws.
  - 3) Have a system interface Back Box: Minimum Two-gang galvanized steel with 2-1/2 inch minimum depth.
  - 4) Have an Internal Speaker: 3 inches, 2.3 oz. minimum; permanent magnet.
  - 5) Have a Call Switch: Mount on faceplate. Permits calls to the system.
  - 6) When approved - in lieu of a standalone microphone, provide a Handset with Hook Switch: Have a Handset with Hook Switch: Telephone type with 24-inch-long, permanently coiled cord. Arrange to disconnect speaker when handset is lifted.
  - 7) Be provided with an electrical supervision panel to provide both audio and visual trouble alarms to the Nurse Call /Code Blue electrical supervision system.
  - 8) Be capable of internal time out capability.
  - 9) Be completely compatible with the Telephone Interface unit(s)
- 2) Electrical Supervision Trouble Annunciator Panel:
- a) The Electrical Supervision Trouble Annunciation Panel shall be located in the TCR and PCR's SCC.
  - b) The panel(s) shall be compatible with the generated electrical and/or electronic supervising signals to continuously monitor the operating condition for the PA system head-end processing equipment, local/remote control consoles, audio power amplifier(s), UPS, power supplies, dome lights and interconnecting trunks. The panels shall generate an audible and visual signal when the System's supervising system detects a system trouble or trunk-line is malfunctioning.
  - c) TRs: Locate the PA floor distribution equipment within each TR as required by system design and OEM direction. Provide secured and lockable cabinet/rack(s) as required.
- 1) General Equipment: Provide all required power supplies, communications hubs, network switches, intelligent controllers and other devices necessary to form a



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complete system listed herein. Equipment components may be rack mounted or wall mounted in a metal enclosure.

3) Amplifiers:

a) Panging Amplifier Equipment:

b) Refer to the Amplifier characteristics described herein Paragraph 2.4.G.f.

c) Provide one (1) spare amplifier in addition to the spare Head End Amplifier.

4) Distributed Amplifier:

a) Provide the type and number of the amplifier(S) required to meet the system design. Provide this unit as complete and separate technical submittal during the IFB review portion of the project.

b) Provide one spare amplifier for each 20% (or portion thereof) of amplifiers used in the system.

5) Provide the equipment in the nearest TER where the System is installed to include the minimum equipment listed herein.

6) Provide minimum of 30 minute battery (UPS) back-up to system components.

7) Equipment Cabinet: Comply with cabinet requirements as aforementioned.

8) Trouble Annunciator Panel: Comply with the panel characteristics identified herein.

C. SCC, PCR, STR, HER: Refer to PG-18-10, Article 7 for specific required equipment and use minimum aforementioned specifications for population.

D. TIP DISTRIBUTION SYSTEM:

1. System Speakers:

a. Ceiling Cone-Type:

1) Minimum Axial Sensitivity: 91 dB at one meter, with 1-W input.

2) Frequency Response: Within plus or minus 3 dB from 70 to 15,000 Hz.

3) Minimum Dispersion Angle: 100 degrees.

4) Line Transformer: Maximum insertion loss of 0.5 dB, power rating equal to speaker's, and at least four level taps.

5) Enclosures: Steel housings or back boxes, acoustically dampened, with front face of at least 0.0478-inch steel and

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whole assembly rust proofed and factory primed; complete with mounting assembly and suitable for surface ceiling, flush ceiling, pendant or wall mounting; with relief of back pressure.

- 6) Baffle: For flush speakers, minimum thickness of 0.032-inch aluminum with textured white finish. Completely fill the baffle with fiberglass.
  - 7) Vandal-Proof, High-Strength Baffle: For flush-mounted speakers, self-aging cast aluminum with tensile strength of 44,000 psi, 0.025-inch minimum thickness; countersunk heat-treated alloy mounting screws; and textured white epoxy finish.
  - 8) Size: 8 inches with 1-inch voice coil and minimum 5-oz. ceramic magnet.
  - 9) Have a minimum of two (2) safety wires installed to a solid surface or use a flexible conduit from ceiling / wall back box to the speaker back box.
  - 10) The speakers and mounting shall be self-contained and wall mounted with flush back box at a minimum of 10 meter intervals and shall match (or contrast with, at the direction of the RE) the color of the adjacent surfaces.
  - 11) Provide one spare speaker, mount, and back box for each 50 speakers or portion thereof.
  - 12) The enclosure for the sound masking speakers shall consist of aluminum or electroplated steel, cylindrical housing.
  - 13) Speakers: 5 ¼ inch units mounted on metal baffles and arranged for optimum, multi-directional, angular sound distribution. Arrange units for suspension from the building structure above the ceiling.
    - a. Size: 5 ¼ inch wide dispersion.
    - b. Power Rating: 10 Watts Root Mean Squared (RMS).
    - c. Frequency Response: 50-12,000 Hz.
    - d. Pressure Sensitivity: SPL - at 1 Watt/m - 90 dB.
    - e. Impedance: 32 Ohms.
    - f. Magnet Weight: 10 oz. (283.5 grams).
- c. System Cables: In addition to the TIP provided under Specification Section 27 15 00 - TIP Horizontal and Vertical

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Communications Cabling, provide the following additional TIP installation and testing requirements, provide the following minimum System TIP cables & interconnections:

- 1) Line Level Audio and Microphone Cable:
  - a) Line level audio and microphone cable for inside racks and conduit.
  - b) Shielded, twisted pair Minimum 22 American Wire Gauge (AWG), stranded conductors and 24 AWG drain wire with overall jacket.
- 2) Speaker Level (Audio 70.7Volt [V]) Cable, Riser Rated:
  - a) For use with 70.7 V audio speaker circuits.
  - b) 18 AWG stranded pair, minimum.
  - c) UL-1333 listed.
- 3) Speaker Level Audio Cable, Plenum Rated (70.7V):
  - a) For use with 70.7 V audio speaker circuits.
  - b) 18 AWG stranded pair, minimum.
- 4) All cabling shall be plenum rated.
- 5) Provide one (1) spare 1,000 foot roll of approved System (not microphone) cable only.

**E. CONTROL UNIT**

1. The system must be capable of being independently zoned on both a global and local level for sound masking, paging and music. All zoning must be controlled from a network appliance:
  - a. System control unit must be LON or BACNET capable.
  - b. System control unit must have digital input/output relays.
  - c. System control unit must have TCP IP and RS 232 serial port.
  - d. Control unit must be able to control entire building without any additional controllers.
  - e. System control unit must be able to be browsed using off the shelf software.
  - f. System control unit must be capable of providing email reports.
  - g. System control unit must be capable of programming alarms, alarm triggers.
  - h. System control unit must be capable of creating data logs.

**F. NOISE GENERATOR: Octave bands from 20Hz to 20 KHz.**

1. Voltage: 48 Volts DC, 60 Hz.
2. Contour Adjustments.

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3. Spectrum adjustment shall meet acoustical preferred curve.

**G. OUTPUT ADJUSTMENTS**

1. 1/3 band EQ for entire spectrum (25Hz - 20KHz). Meets ANSI specification for bands.
2. Parametric EQ for entire spectrum (20Hz - 20KHz).
3. Central volume control, contour control and EQ control for zones for sound masking.
4. Central volume control, and EQ control for zones and units for paging and music.

**H. WIRE:**

1. The power wiring shall be minimum 16 gauge, stranded, non-shielded, UL Listed, Plenum Rated.
2. The data wiring shall be CAT 5, CAT 5e, or CAT 6, 4 pair, with an RJ45 jack.
3. The audio wiring shall be CAT 5, CAT 5e, or CAT 6, 4 pair, with an RJ45 jack.
4. All Wire to be plenum and properly rated.

**I. POWER SUPPLY:**

Output:

DC VOLTAGE: 48v

RATED CURRENT: 3.2A

CURRENT RANGE: 0~3.2A

RATED POWER: 150/320/500 W

OUTPUT VOLTAGE ADJ. RANGE: 45.6~52.8V

LINE REGULATION:  $\pm 0.5\%$

LOAD REGULATION:  $\pm 0.5\%$

SETUP, RISE TIME: 600ms, 30ms at full load

HOLD UP TIME (Typ.): 20ms at full load

Input:

VOLTAGE RANGE: 85~264VAC      120~370VDC

FREQUENCY RANGE: 47~63Hz

POWER FACTOR (Typ.): PF>0.93/230VAC      PF>0.98/115VAC at  
full load

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AC CURRENT (Typ.): 2.5A/115VAC                      1.2A/230VAC

INRUSH CURRENT (Typ.): Cold Start 40A/230VAC

Safety: & EMC

SAFETY STANDARDS: UL60950-1, TUV EN60950-1 and S-Mark  
J60950 Approved

HARMONIC CURRENT: Compliance to EN61000-3-2,-3

EMS IMMUNITY: Compliance to EN61000-4-2,3,4,5,6,8,11;  
ENV50204, EN55024

Environment:

WORKING HUMIDITY: 20 ~ 90% RH non-condensing

WORKING TEMP: -10 ~ +60 (Refer to output load derating  
curve)

STORAGE TEMP., HUMIDITY: -20 ~ +85 , 10 ~ 95% RH

TEMP. COEFFICIENT: 0.05%/ (0 ~ 50°C)

VIBRATION: 10 ~ 500Hz, 2G 10min./1cycle, 60min. each along  
X, Y, Z axes

Others:

MTBF: 191.2K hrs min.                      MIL-HDBK-217F (25°C)

DIMENSION: 7 27/32" x 3 29/32" x 1 15/16"

Protection:

OVERLOAD: 105 ~ 150% rated output power

Protection type: Constant current limiting, recovers  
automatically after fault condition is removed

OVER VOLTAGE: 52.8 ~ 64.8V

OVER TEMPERATURE: 95°C±5°C (TSW1: Detect on Heat sink of  
Power Transistor)

Protection type: Shut down o/p voltage, recovers  
automatically after temperature goes down

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J. REMOTE CENTRAL VOLUME CONTROL:

1. Generation and integration of multiple random sound masking sources. Channel outputs with three levels of global and independent control.
  - a. Contour control - At the source using infra-red technology for each independent channel, quad-pod and global control or via a centralized control.
  - b. Parametric equalization control for one to minimum of 6,400 speakers.
  - c. 1/3 Band Octave controls - (Same as Parametric controls for groups)
  - d. Volume control for entire spaces to channels to individual speakers.
2. Integration of separate paging and music channels.
  - a. Each channel can be digitally controlled for zone management and changed on the fly without any change in wiring. No need to go back into the ceiling to change settings.

K. PROGRAMABLE AUDIO LEVEL CONTROL:

1. Standard applications include scheduling, data logging, alarm detection & dispatch, meter reading, analog functions, and type translation. The scheduling application permits events and exceptions to be initiated based on time and date schedules configured by the user. An astronomical position calculator permits scheduling to be done based on the calculated position of the sun. The data logging application collects network activity for use by trending, reporting, and analysis applications. New DIME support enables data log upload to a Web services application to occur through a firewall. The alarming application provides a means to identify, annunciate, and log alarm conditions. The meter reading application supervises impulse meters and provides suitable conversion values for energy, gas, and water metering. Automatic Sound Power Level Changes: Two system channel changes, four times per day, and capable of different time settings for each day of the week:
  - a. Programmable attenuation range: -24 to +24 dB (48 dB)
  - b. Slide control attenuation range: -24 to +24 dB
  - c. Minutes per dB change: User programmable
  - d. Acclimation attenuation range: -24 to +24 dB

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- e. Acclimate days per dB change: 1 to 5 days
- f. Programmable events: 24 events per day for each zone
- 2. Program Memory: Nonvolatile for one year, minimum, without power. When re-energized after a power outage, control starts at zero level and automatically advances system sound level at same rate used for programmed level changes.

**L. PAGING / MUSIC INTERFACE:**

- 1. The Music Page Interface shall perform to the following requirements:
  - a. The music page interface should replace all bulky head end equipment. There should be no need for additional cable home-runs, amplifiers, separate equalizers, special switching equipment or matching vendors for compatible product interfaces.
  - b. The music page interface must be able to make zone additions, modifications, deletions and other changes to the paging and music/EBS system without rewiring.
  - c. The music page interface must be able to provide a minimum ability to program up to 100 zones for paging using DTMF tones through standard POTS telephone line. MPI must be able to be programmed for all call and emergency broadcast paging with priority.
  - d. Each zone and group must have a dedicated one band octave equalizer that is able to adjust either individual zones or groups.
  - e. The music page interface must be able to from one point manage up to 1.5 million square feet of space through a single interface.
  - f. Volume and equalizer settings for paging and music must be administered in no more than ½ dB steps.
  - g. The music page interface must automatically compensate and readjust for frequency line loss, broadcast and correct throughout the entire system at each node.
  - h. Shall include Telephone, (2) Audio and Aux inputs with priority call.
  - i. Momentary push button sequencer to sequentially initialize attached nodes.
  - j. Play Relay.

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- k. Must have a line level variable input controller for audio inputs.
- l. Must have a digital LED display showing line level input for High, Medium and Low.
- 2. Raceways, Back Boxes and conduit:
  - a. Raceways:
    - 1) In addition to the Raceways, Equipment Room Fittings provided under Specification Sections 27 15 00 TIP Communication Room Fittings and 27 15 00 - TIP Communications Horizontal and Vertical Cabling, provide the following additional TIP raceway and fittings:
    - 2) Each raceway that is open top, shall be: UL certified for telecommunications systems, partitioned with metal partitions in order to comply with NEC Parts 517 & 800 to "mechanically separate telecommunications systems of different service, protect the installed cables from falling out when vertically mounted and allow junction boxes to be attached to the side to interface "drop" type conduit cable feeds.
    - 3) Intercommunication System cable infrastructure: EMT or in J-hooks above accessible ceilings, 24 inches on center.
    - 4) Junction boxes shall be not less than 2-1/2 inches deep and 6 inches wide by 6 inches long.
    - 5) Flexible metal conduit is prohibited unless specifically approved by 0050P3B.
  - b. System Conduit:
    - 1) The PA system is NFPA listed as Emergency / Public Safety Communication System which requires the entire system to be installed in a separate conduit system.
    - 2) The use of centralized mechanically partitioned wireways may be used to augment main distribution conduit on a case by case basis when specifically approved by VA Headquarters (0050P3B).
    - 3) Conduit Sleeves:
      - a) The AE has made a good effort to identify where conduit sleeves through full-height and fire rated walls on the drawings, and has instructed the electrician to provide the sleeves as shown on the drawings.



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b) While the sleeves shown on the drawings will be provided by others, the contractor is responsible for installing conduit sleeves and fire-proofing where necessary. It is often the case, that due to field conditions, the nurse-call cable may have to be installed through an alternate route. Any conduit sleeves required due to field conditions or those omitted by the engineer shall be provided by the cabling contractor.

3. Device Back Boxes:

- a. Furnish to the electrical contractor all back boxes required for the PA system devices.
- b. The electrical contractor shall install the back boxes as well as the system conduit. Coordinate the delivery of the back boxes with the construction schedule.

4. Telecommunication Outlets (TCO): Populate each TCO that is required to perform system operations in the locations that were provided and cabled as a part of Specifications Sections 27 11 00 and 27 15 00. Provide additional TCO equipment, interfaces and connections as required by System design. Provide secured pathway(s) and TCOs as required.

5. UPS:

- a. Provide a backup battery or a UPS for the System to allow normal operation and function (as if there was no AC power failure) in the event of an AC power failure or during input power fluctuations for a minimum of four (4) hours.
- b. As an alternate solution, the telephone system UPS may be utilized to meet this requirement at the headend location, as long as this function is specifically approved by the Telephone Contractor and the RE.
- c. The PA Contractor shall not make any attachments or connection to the telephone system until specifically directed to do so, in writing, by the RE.
- d. Provide UPS for all active system components including but not limited to:
  - 1) System Amplifiers.
  - 2) Microphone Consoles.
  - 3) Telephone Interface Units.

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4) TER, TR & Headend Equipment Rack(s).

**M. Patient Bedside Prefabricated Units (PBPUs):**

1. Where PBPUs exist in the Facility; the Contractor shall identify the "gang box" location on the PBPUs designated for installation of the telephone jack. This location shall here-in-after be identified as the unit's TCO. The Contractor shall be responsible for obtaining written approval and specific instructions from the PBPUs OEM regarding the necessary disassembly and reassembly of each PBPUs to the extent necessary to pull wire from above the TIP ceiling junction box to the PBPUs reserved gang box for the unit's TCO. A Contractor provided stainless steel cover plate approved for use by the PBPUs OEM and Facility IRM Chief shall finish out the jack installation.
2. Under no circumstances shall the Contractor proceed with the PBPUs installations without the written approval of the PBPUs OEM and the specific instructions regarding the attachment to or modifying of the PBPUs. The RE shall be available to assist the Contractor in obtaining approvals and instructions in a timely manner as related to the project's time constraints.
3. It is the responsibility of the Contractor to maintain the UL integrity of each PBPUs. If the Contractor violates that integrity, it shall be the responsibility of the Contractor to obtain on site UL re-certification of the violated PBPUs at the direction of the RE and at the Contractor's expense.

**N. Installation Kit:**

1. General: The kit shall be provided that, at a minimum, includes all connectors and terminals, labeling systems, audio spade lugs, barrier strips, punch blocks or wire wrap terminals, heat shrink tubing, cable ties, solder, hangers, clamps, bolts, conduit, cable duct, and/or cable tray, etc., required to accomplish a neat and secure installation. All wires shall terminate in a spade lug and barrier strip, wire wrap terminal or punch block. Unfinished or unlabeled wire connections shall not be allowed. Turn over to the RE all unused and partially opened installation kit boxes, coaxial, fiberoptic, and twisted pair cable reels, conduit, cable tray, and/or cable duct bundles, wire rolls, physical installation

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- hardware. The following are the minimum required installation sub-kits:
2. System Grounding:
    - a. The grounding kit shall include all cable and installation hardware required. All radio equipment shall be connected to earth ground via internal building wiring, according to the NEC.
    - b. This includes, but is not limited to:
      - 1) Coaxial Cable Shields.
      - 2) Control Cable Shields.
      - 3) Data Cable Shields.
      - 4) Equipment Racks.
      - 5) Equipment Cabinets.
      - 6) Conduits.
      - 7) Duct.
      - 8) Cable Trays.
      - 9) Power Panels.
      - 10) Connector Panels.
      - 11) Grounding Blocks.
  3. Coaxial Cable: The coaxial cable kit shall include all coaxial connectors, cable tying straps, heat shrink tabbing, hangers, clamps, etc., required to accomplish a neat and secure installation.
  4. Wire and Cable: The wire and cable kit shall include all connectors and terminals, audio spade lugs, barrier straps, punch blocks, wire wrap strips, heat shrink tubing, tie wraps, solder, hangers, clamps, labels etc., required to accomplish a neat and orderly installation.
  5. Conduit, Cable Duct, and Cable Tray: The kit shall include all conduit, duct, trays, junction boxes, back boxes, cover plates, feed through nipples, hangers, clamps, other hardware required to accomplish a neat and secure conduit, cable duct, and/or cable tray installation in accordance with the NEC and this document.
  6. Equipment Interface: The equipment kit shall include any item or quantity of equipment, cable, mounting hardware and materials needed to interface the systems with the identified sub-system(s) according to the OEM requirements and this document.
  7. Labels: The labeling kit shall include any item or quantity of labels, tools, stencils, and materials needed to completely and

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correctly label each subsystem according to the OEM requirements, as-installed drawings, and this document.

8. Documentation: The documentation kit shall include any item or quantity of items, computer discs, as installed drawings, equipment, maintenance, and operation manuals, and OEM materials needed to completely and correctly provide the system documentation as required by this document and explained herein.

**PART 3 - EXECUTION**

**3.1 PROJECT MANAGEMENT**

- A. Assign a single project manager to this project who will serve as the point of contact for the Resident Engineer, the General Contractor, and the Engineer.
- B. The Contractor shall be proactive in scheduling work at the hospital, specifically the Contractor will initiate and maintain discussion with the general contractor regarding the schedule for ceiling cover up and install cables to meet that schedule.
- C. Contact the Office of Telecommunications, Special Communications Team (0050P3B) at (301) 734-0350 to have a VA Certified Telecommunications COTR assigned to the project for telecommunications review, equipment and system approval and co-ordination with VA's Spectrum Management and OCIS Teams.

**3.2 COORDINATION WITH OTHER TRADES**

- A. Coordinate with the cabling contractor the location of the PA system faceplate and the faceplate opening for the PA system back boxes.
- B. Coordinate with the cabling contractor the location of TIP equipment in the TER, TCR, PA, PCR, SCC, ECR, STRs, NSs, HER and TCOs in order to connect to the TIP cable network that was installed as a part of Section Specification 27 11 00. Contact the RE immediately, in writing, if additional location(s) are discovered to be activated that was not previously provided.
- C. Before beginning work, verify the location, quantity, size and access for the following:
  1. Isolated ground AC power circuits provided for systems.
  2. Junction boxes, wall boxes, wire troughs, conduit stubs and other related infrastructure for the systems.
  3. System components installed by others.
  4. Overhead supports and rigging hardware installed by others.

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- D. Immediately notify the Resident Engineer, GC and Consultant(s) in writing of any discrepancies

**3.3 NEEDS ASSESSMENT**

Provide a one-on-one meeting with the particular manager of each unit affected by the installation of the new PA system. Review the floor plan drawing, educate the nursing manager with the functions of the equipment that is being provided and gather details specific to the individual units; coverage and priorities of calls; staffing patterns; and other pertinent details that will affect system programming and training.

**3.4 INSTALLATION**

A. General

1. Execute work in accordance with National, State and local codes, regulations and ordinances.
2. Install work neatly, plumb and square and in a manner consistent with standard industry practice. Carefully protect work from dust, paint and moisture as dictated by site conditions. The Contractor will be fully responsible for protection of his work during the construction phase up until final acceptance by the VAMC.
3. Install equipment according to OEM's recommendations. Provide any hardware, adaptors, brackets, rack mount kits or other accessories recommended by OEM for correct assembly and installation.
4. Secure equipment firmly in place, including receptacles, speakers, equipment racks, system cables, etc.
  - a. All supports, mounts, fasteners, attachments and attachment points shall support their loads with a safety factor of at least 5:1.
  - b. Do not impose the weight of equipment or fixtures on supports provided for other trades or systems.
  - c. Any suspended equipment or associated hardware must be certified by the OEM for overhead suspension.
  - d. The Contractor is responsible for means and methods in the design, fabrication, installation and certification of any supports, mounts, fasteners and attachments.

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5. Locate overhead ceiling-mounted loudspeakers as shown on drawings, with minor changes not to exceed 12" in any direction.
  - a. Mount transformers securely to speaker brackets or enclosures using screws. Adjust torsion springs as needed to securely support speaker assembly.
  - b. Speaker back boxes shall be completely filled with fiberglass insulation.
  - c. Seal cone speakers to their enclosures to prevent air passing from one side of the speaker to the other.
- d. Mountings and Loudspeakers shall be concealed above the acoustical ceiling. The loudspeakers shall be suspended from the slab above by chain. Where possible, the bottom, of each speaker shall be located a minimum of 6" to 8" (150 to 200mm) above the acoustical ceiling tile. It is most important that all units hang at a uniform height throughout to insure a uniformity of sound when the system is turned on.
- e. Ensure that loudspeakers are suspended in a level manner.
- f. Ensure that loudspeakers are not obstructed as much as possible.
6. Finishes for any exposed work such as plates, racks, panels, speakers, etc. shall be approved by the Architect, Resident Engineer and 0050P3B.
7. Coordinate cover plates with field conditions. Size and install cover plates as necessary to hide joints between back boxes and surrounding wall. Where cover plates are not fitted with connectors, provide grommets in size and quantity required. Do not allow cable to leave or enter boxes without cover plates installed.
8. Active electronic component equipment shall consist of solid state components, be rated for continuous duty service, comply with the requirements of FCC standards for telephone and data equipment, systems, and service.
9. Color code all distribution wiring to conform to the PA Industry Standard, EIA/TIA, and this document, whichever is the more stringent. At a minimum, all equipment, cable duct and/or conduit, enclosures, wiring, terminals, and cables shall be clearly and permanently labeled according to and using the provided record drawings, to facilitate installation and maintenance.

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10. Connect the System's primary input AC power to the Facility's Critical Branch of the Emergency AC power distribution system as shown on the plans or if not shown on the plans consult with RE regarding a suitable circuit location prior to bidding.

11. Product Delivery, Storage and Handling:

a. Delivery: Deliver materials to the job site in OEM's original unopened containers, clearly labeled with the OEM's name and equipment catalog numbers, model and serial identification numbers. The RE may inventory the cable, patch panels, and related equipment.

b. Storage and Handling: Store and protect equipment in a manner, which will preclude damage as directed by the RE.

12. Where TCOs are installed adjacent to each other, install one outlet for each instrument.

13. Equipment installed outdoors shall be weatherproof or installed in weatherproof enclosures with hinged doors and locks with two keys.

B. Equipment Racks:

1. Fill unused equipment mounting spaces with blank panels or vent panels. Match color to equipment racks.

2. Provide security covers for all devices not requiring routine operator control.

3. Provide vent panels and cooling fans as required for the operation of equipment within the OEM's specified temperature limits. Provide adequate ventilation space between equipment for cooling. Follow manufacturer's recommendations regarding ventilation space between amplifiers.

4. Provide insulated connections of the electrical raceway to equipment racks.

5. Provide continuous raceway/conduit with no more than 40% fill between wire troughs and equipment racks for all non-plenum-rated cable. Ensure each system is mechanically separated from each other in the wireway.

6. Ensure a minimum of 36 inches around each cabinet and/or rack to comply with OSHA Safety Standards. Cabinets and/or Racks installed side by side - the 36" rule applies to around the entire assembly

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C. Distribution Frames.

1. A new stand-alone (i.e., self-supporting, free standing) PA rack/frame may be provided in each TR to interconnect the PA, TER, TCR, PCR, SCC, STRs & ECRs. Rack/frames shall be wired in accordance with industry standards and shall employ "latest state-of-the-art" modular cross-connect devices. The PA riser cable shall be sized to satisfy all voice/digital requirements plus not less than 50% spare (growth) capacity in each TR which includes a fiber optic backbone.
2. The frames/racks shall be connected to the TER/MCR system ground.

D. Wiring Practice - in addition to the MANDATORY infrastructure requirements outlined in VA Construction Specifications 27 10 00 - TIP Structured Communications Cabling, 27 11 00 - TIP Communications Rooms Fittings and 27 15 00 - TIP Horizontal and Vertical Communicators Cabling, the following additional practices shall be adhered too:

1. Comply with requirements for raceways and boxes specified in Division 26 Section "Raceway and Boxes for Electrical Systems."
2. Execute all wiring in strict adherence to the National Electrical Code, applicable local building codes and standard industry practices.
3. Wiring shall be classified according to the following low voltage signal types:
  - a. Balanced microphone level audio (below -20dBm) or Balanced line level audio (-20dBm to +30dBm)
  - b. 70V audio speaker level audio.
  - c. Low voltage DC control or power (less than 48VDC)
4. Where raceway is to be EMT (conduit), wiring of differing classifications shall be run in separate conduit. Where raceway is to be an enclosure (rack, tray, wire trough, utility box) wiring of differing classifications which share the same enclosure shall be mechanically partitioned and separated by at least four (4) inches. Where Wiring of differing classifications must cross, they shall cross perpendicular to one another.
5. Do not splice wiring anywhere along the entire length of the run. Make sure cables are fully insulated and shielded from each other and from the raceway for the entire length of the run.



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6. Do not pull wire through any enclosure where a change of raceway alignment or direction occurs. Do not bend wires to less than radius recommended by manufacturer.
7. Replace the entire length of the run of any wire or cable that is damaged or abraded during installation. There are no acceptable methods of repairing damaged or abraded wiring.
8. Use wire pulling lubricants and pulling tensions as recommended by the OEM.
9. Use grommets around cut-outs and knock-outs where conduit or chase nipples are not installed.
10. Do not use tape-based or glue-based cable anchors.
11. Ground shields and drain wires to the Facility's signal ground system as indicated by the drawings.
12. Field wiring entering equipment racks shall be terminated as follows:
  - a. Provide ample service loops at harness break-outs and at plates, panels and equipment. Loops should be sufficient to allow plates, panels and equipment to be removed for service and inspection.
  - b. Line level and speaker level wiring may be terminated inside the equipment rack using specified terminal blocks (see "Products.") Provide 15% spare terminals inside each rack. Microphone level wiring may only be terminated at the equipment served.
  - c. If specified terminal blocks are not designed for rack mounting, utilize ¾" plywood or 1/8" thick aluminum plates/blank panels as a mounting surface. Do not mount on the bottom of the rack.
  - d. Employ permanent strain relief for any cable with an outside diameter of 1" or greater.
13. Use only balanced audio circuits unless noted otherwise
14. Make all connections as follows:
  - a. Make all connections using rosin-core solder or mechanical connectors appropriate to the application.
  - b. For crimp-type connections, use only tools that are specified by the manufacturer for the application.
  - c. Use only insulated spade lugs on screw terminals. Spade lugs shall be sized to fit the wire gauge. Do not exceed two lugs per terminal.

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- d. Wire nuts, electrical tape or "Scotch Lock" connections are not acceptable for any application.
15. Make all connections as follows:
- a. Make all connections using rosin-core solder or mechanical connectors appropriate to the application.
  - b. For crimp-type connections, use only tools that are specified by the manufacturer for the application.
  - c. Use only insulated spade lugs on screw terminals. Spade lugs shall be sized to fit the wire gauge. Do not exceed two lugs per terminal.
  - d. Wire nuts, electrical tape or "Scotch Lock" connections are not acceptable for any application.
16. Noise filters and surge protectors shall be provided for each equipment interface cabinet, switch equipment cabinet, control console, local, and remote active equipment locations to ensure protection from input primary AC power surges and noise glitches are not induced into low Voltage data circuits.
17. Wires or cables previously approved to be installed outside of conduit, cable trays, wireways, cable duct, etc:
- a. Only when specifically authorized as described herein, will wires or cables be identified and approved to be installed outside of conduit. The wire or cable runs shall be UL rated plenum and OEM certified for use in air plenums.
  - b. Wires and cables shall be hidden, protected, fastened and tied at 600 mm (24 in.) intervals, maximum, as described herein to building structure.
  - c. Closer wire or cable fastening intervals may be required to prevent sagging, maintain clearance above suspended ceilings, remove unsightly wiring and cabling from view and discourage tampering and vandalism. Wire or cable runs, not provided in conduit, that penetrate outside building walls, supporting walls, and two hour fire barriers shall be sleeved and sealed with an approved fire retardant sealant.
  - d. Wire or cable runs to system components installed in walls (i.e.: volume attenuators, circuit controllers, signal, or data outlets, etc.) may, when specifically authorized by the RE, be fished

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through hollow spaces in walls and shall be certified for use in air plenum areas.

- e. Completely test all of the cables after installation and replace any defective cables.
  - f. Wires or cables that are installed outside of buildings shall be in conduit, secured to solid building structures. If specifically approved, on a case by case basis, to be run outside of conduit, the wires or cables shall be installed, as described herein. The bundled wires or cables must: Be tied at not less than 460 mm (18 in.) intervals to a solid building structure; have ultra violet protection and be totally waterproof (including all connections). The laying of wires or cables directly on roof tops, ladders, drooping down walls, walkways, floors, etc. is not allowed and will not be approved.
- E. Cable Installation - In addition to the **MANDATORY** infrastructure requirements outlined in VA Construction Specifications 27 10 00 - Structured TIP Communications Cabling, 27 11 00 - TIP Communications Rooms and Fittings and 27 15 00 - TIP Communications Horizontal and Vertical Cabling and the following additional practices shall be adhered too:
- 1. Support cable on maximum 2'-0" centers. Acceptable means of cable support are cable tray, j-hooks, and bridal rings. Velcro wrap cable bundles loosely to the means of support with plenum rated Velcro straps. Plastic tie wraps are not acceptable as a means to bundle cables.
  - 2. Run cables parallel to walls.
  - 3. Install maximum of 10 cables in a single row of J-hooks. Provide necessary rows of J-hooks as required by the number of cables.
  - 4. Do not lay cables on top of light fixtures, ceiling tiles, mechanical equipment, or ductwork. Maintain at least 2'-0" clearance from all shielded electrical apparatus.
  - 5. All cables shall be tested after the total installation is fully complete. All test results are to be documented. All cables shall pass acceptable test requirements and levels. Contractor shall remedy any cabling problems or defects in order to pass or comply with testing. This includes the re-pull of new cable as required at no additional cost to the VAMC.

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6. Ends of cables shall be properly terminated on both ends per industry and OEM's recommendations.
7. Provide proper temporary protection of cable after pulling is complete before final dressing and terminations are complete. Do not leave cable lying on floor. Bundle and tie wrap up off of the floor until you are ready to terminate.
8. Terminate all conductors; no cable shall contain unterminated elements. Make terminations only at outlets and terminals.
9. Splices, Taps, and Terminations: Arrange on numbered terminal strips in junction, pull, and outlet boxes; terminal cabinets; and equipment enclosures. Cables may not be spliced.
10. Bundle, lace, and train conductors to terminal points without exceeding OEM's limitations on bending radii. Install lacing bars and distribution spools.
11. Cold-Weather Installation: Bring cable to room temperature before dereeling. Heat lamps shall not be used.
12. Cable shall not be run through structural members or be in contact with pipes, ducts, or other potentially damaging items.
13. Separation of Wires: (REFER TO RACEWAY INSTALLATION) Separate speaker-microphone, line-level, speaker-level, and power wiring runs. Install in separate raceways or, where exposed or in same enclosure, separate conductors at least 12 inches apart for speaker microphones and adjacent parallel power and telephone wiring. Separate other intercommunication equipment conductors as recommended by equipment manufacturer.
14. Serve all cables as follows:
  - a. Cover the end of the overall jacket with a 1" (minimum) length of transparent heat-shrink tubing. Cut unused insulated conductors 2" (minimum) past the heat-shrink, fold back over jacket and secure with cable-tie. Cut unused shield/drain wires 2" (minimum) past the Heatshrink and serve as indicated below.
  - b. Cover shield/drain wires with heat-shrink tubing extending back to the overall jacket. Extend tubing ¼" past the end of unused wires, fold back over jacket and secure with cable tie.
  - c. For each solder-type connection, cover the bare wire and solder connection with heat-shrink tubing.

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- F. Labeling: Provide labeling in accordance with ANSI/EIA/TIA-606-B. All lettering for PA circuits shall be stenciled using laser printers
1. Cable and Wires (Hereinafter referred to as "Cable"): Cables shall be labeled at both ends in accordance with ANSI/EIA/TIA-606-B. Labels shall be permanent in contrasting colors. Cables shall be identified according to the System "Record Wiring Diagrams."
  2. Equipment: System equipment shall be permanently labeled with contrasting plastic laminate or Bakelite material. System equipment shall be labeled on the face of the unit corresponding to its source.
    - a. Clearly, consistently, logically and permanently mark switches, connectors, jacks, relays, receptacles and electronic and other equipment.
    - b. Engrave and paint fill all receptacle panels using 1/8" (minimum) high lettering and contrasting paint.
    - c. For rack-mounted equipment, use engraved Lamacoid labels with white 1/8" (minimum) high lettering on black background. Label the front and back of all rack-mounted equipment.
  3. Conduit, Cable Duct, and/or Cable Tray: The Contractor shall label all conduit, duct and tray, including utilized GFE, with permanent marking devices or spray painted stenciling a minimum of 3 meters (10 ft.) identifying it as the System. In addition, each enclosure shall be labeled according to this standard.
  4. Termination Hardware: The Contractor shall label TCOs and patch panel connections using color coded labels with identifiers in accordance with ANSI/EIA/TIA-606-A and the "Record Wiring Diagrams."
  5. Where multiple pieces of equipment reside in the same rack group, clearly and logically label each indicating to which room, channel, receptacle location, etc. they correspond.
  6. Permanently label cables at each end, including intra-rack connections. Labels shall be covered by the same, transparent heat-shrink tubing covering the end of the overall jacket. Alternatively, computer generated labels of the type which include a clear protective wrap may be used.
  7. Contractor's name shall appear no more than once on each continuous set of racks. The Contractor's name shall not appear on wall plates or portable equipment.

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8. Ensure each OEM supplied item of equipment has appropriate UL Labels / Marks for the service the equipment is performed permanently attached / marked. SYSTEM EQUIPMENT INSTALLED NOT BEARING THESE UL MARKS WILL NOT BE ALLOWED TO BE A PART OF THE SYSTEM. THE CONTRACTOR SHALL BEAR ALL COSTS REQUIRED TO PROVIDE REPLACEMENT EQUIPMENT WITH APPROVED UL MARKS.

G. Conduit and Signal Ducts: When the Contractor and/or OEM determines additional system conduits and/or signal ducts are required in order to meet the system minimum performance standards outlined herein, the contractor shall provide these items as follows:

1. Conduit:

- a. The Contractor shall employ the latest installation practices and materials. The Contractor shall provide conduit, junction boxes, connectors, sleeves, weather heads, pitch pockets, and associated sealing materials not specifically identified in this document as GFE. Conduit penetrations of walls, ceilings, floors, interstitial space, fire barriers, etc., shall be sleeved and sealed.
- b. All cables shall be installed in separate conduit and/or signal ducts (exception from the separate conduit requirement to allow PA cables to be installed in partitioned cable tray with voice cables may be granted in writing by the RE if requested). Conduits shall be provided in accordance with Section 27 05 33, RACEWAYS AND BOXES FOR COMMUNICATIONS SYSTEMS, and NEC Articles 517 for Critical Care and 800 for Communications systems, at a minimum.
- c. When metal, plastic covered, etc., flexible cable protective armor or systems are specifically authorized to be provided for use in the System, their installation guidelines and standards shall be as specified herein, Section 27 05 33, RACEWAYS AND BOXES FOR COMMUNICATIONS SYSTEMS, and the NEC.
- d. When "interduct" flexible cable protective systems is specifically authorized to be provided for use in the System, it's installation guidelines and standards shall be as the specified herein, Section 27 05 33, RACEWAYS AND BOXES FOR COMMUNICATIONS SYSTEMS, and the NEC.

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- e. Conduit fill (including GFE approved to be used in the system) shall not exceed 40%. Each conduit end shall be equipped with a protective insulator or sleeve to cover the conduit end, connection nut or clamp, to protect the wire or cable during installation and remaining in the conduit. Electrical power conduit shall be installed in accordance with the NEC. AC power conduit shall be run separate from signal conduit.
  - f. Ensure that Critical Care PA, and Mass Notification Systems (as identified by NEC Section 517) are completely separated and protected from all other systems.
2. Signal Duct, Cable Duct, or Cable Tray:
- a. The Contractor shall use GFE signal duct, cable duct, and/or cable tray, when identified and approved by the RE.
  - b. Approved signal and/or cable duct shall be a minimum size of 100 mm x 100 mm (4 in. X 4 in.) inside diameter with removable tops or sides, as appropriate. Protective sleeves, guides or barriers are required on all sharp corners, openings, anchors, bolts or screw ends, junction, interface and connection points.
  - c. Approved cable tray shall be fully covered, mechanically and physically partitioned for multiple electronic circuit use, and be UL certified and labeled for use with telecommunication circuits and/or systems. The RE shall approve width and height dimensions.
  - d. All cable junctions and taps shall be accessible. Provide an 8" X 8" X 4" (minimum) junction box attached to the cable duct or raceway for installation of distribution system passive equipment. Ensure all equipment and tap junctions are accessible

**3.5 PROTECTION OF NETWORK DEVICES**

Contractor shall protect network devices during unpacking and installation by wearing manufacturer approved electrostatic discharge (ESD) wrist straps tied to chassis ground. The wrist strap shall meet OSHA requirements for prevention of electrical shock, should technician come in contact with high voltage.

**3.6 CUTTING, CLEANING AND PATCHING**

- A. It shall be the responsibility of the contractor to keep their work area clear of debris and clean area daily at completion of work.

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- B. It shall be the responsibility of the contractor to patch and paint any wall or surface that has been disturbed by the execution of this work.
- C. The Contractor shall be responsible for providing any additional cutting, drilling, fitting or patching required that is not indicated as provided by others to complete the Work or to make its parts fit together properly.
- D. The Contractor shall not damage or endanger a portion of the Work or fully or partially completed construction of the VAMC or separate contractors by cutting, patching or otherwise altering such construction, or by excavation. The Contractor shall not cut or otherwise alter such construction by the VAMC or a separate contractor except with written consent of the Resident Engineer and of such separate contractor; such consent shall not be unreasonably withheld. The Contractor shall not unreasonably withhold from the Resident Engineer or a separate Contractor the Contractor's consent to cutting or otherwise altering the Work.
- E. Where coring of existing (previously installed) concrete is specified or required, including coring indicated under unit prices, the location of such coring shall be clearly identified in the field and the location shall be approved by the Project Manager prior to commencement of coring work.

**3.7 FIREPROOFING**

- A. Where PA wires, cables and conduit penetrate fire rated walls, floors and ceilings, fireproof the opening.
- B. Provide conduit sleeves (if not already provided by electrical contractor) for cables that penetrate fire rated walls and Telecommunications Rooms floors and ceilings. After the cabling installation is complete, install fire proofing material in and around all conduit sleeves and openings. Install fire proofing material thoroughly and neatly. Seal all floor and ceiling penetrations.
- C. Use only materials and methods that preserve the integrity of the fire stopping system and its rating.
- D. Install fireproofing where low voltage cables are installed in the same manholes with high voltage cables; also cover the low voltage cables with arc proof and fireproof tape.
- E. Use approved fireproofing tape of the same type as used for the high voltage cables, and apply the tape in a single layer, one-half lapped



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or as recommended by the manufacturer. Install the tape with the coated side towards the cable and extend it not less than 25 mm (one inch) into each duct.

F. Secure the tape in place by a random wrap of glass cloth tape.

**3.8 GROUNDING**

- A. Ground PA cable shields and equipment to eliminate shock hazard and to minimize ground loops, commonmode returns, noise pickup, cross talk, and other impairments as specified in CFM Division 27, Section 27 05 26 - Grounding and Bonding for Communications Systems.
- B. Facility Signal Ground Terminal: Locate at main room or area signal ground within the room (i.e. head end and telecommunications rooms) or area(s) and indicate each signal ground location on the drawings.
- C. Extend the signal ground to inside each equipment cabinet and/or rack. Ensure each cabinet and/or rack installed item of equipment is connected to the extended signal ground. Isolate the signal ground from power and major equipment grounding systems.
- D. When required, install grounding electrodes as specified in CFM Division 26, Section 26 05 26 -Grounding and Bonding for Electrical Systems.
- E. Do not use "3<sup>rd</sup> or 4<sup>th</sup>" wire internal electrical system conductors for communications signal ground.
- F. Do not connect the signal ground to the building's external lightning protection system.
- G. Do Not "mix grounds" of different systems.
- H. Insure grounds of different systems are installed as to not violate OSHA Safety and NEC installation requirements for protection of personnel.

**PART 4 - TESTING / GUARANTY / TRAINING**

**4.0 SYSTEM LISTING**

The PA System is NFPA listed as an "Emergency / Public Safety" Communications system. Where Code Blue signals are transmitted, that listing is elevated to "Life Support/Safety." Therefore, the following testing and guaranty provisions are the minimum to be performed and provided by the contractor and OEM.

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**4.1 PROOF OF PERFORMANCE TESTING**

**A. Intermediate Testing:**

1. After completion of 25 - 30% the installation of a head end cabinet(s) and equipment, one microphone console, local and remote enunciation stations, two (2) zones, two (2) sub zones prior to any further work, this portion of the system must be pretested, inspected, and certified. Each item of installed equipment shall be checked to ensure appropriate UL Listing and Certification Labels are affixed as required by NFPA -Life Safety Code 101-3.2 (a) & (b) and JCHCO evaluation guidelines, and proper installation practices are followed. The intermediate test shall include a full operational test.
2. All inspections and tests shall be conducted by an OEM-certified contractor representative and witnessed by TVE-0050P3B if there is no local Government Representative that processes OEM and VA approved Credentials to inspect and certify the system. The results of the inspection will be officially recorded by the Government Representative and maintained on file by the RE, until completion of the entire project. The results will be compared to the Acceptance Test results. An identical inspection may be conducted between the 65 - 75% of the system construction phase, at the direction of the RE.

**B. Pretesting:**

1. Play Masking and Audio for a minimum of one hour prior to commissioning to ensure that all amplifiers in the system are working properly.
2. Upon completing installation of the PA System, the Contractor shall align, balance, and completely pretest the entire system under full operating conditions.
3. Pretesting Procedure:
  - a. During the System Pretest the Contractor shall verify (utilizing approved test equipment) that the System is fully operational and meets all the System performance requirements of this standard.
  - b. The Contractor shall pretest and verify that all PA System functions and specification requirements are met and operational, no unwanted aural effects, such as signal distortion, noise pulses, glitches, audio hum, poling noise, etc. are present. At a

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minimum, each of the following locations shall be fully pretested:

- 1) Central Control Cabinets.
  - 2) Local Control Stations.
  - 3) Zone Equipment/Systems.
  - 4) Sub-Zone Equipment/Systems.
  - 5) Remote Control Panels.
    - a.)TCR.
  - 6) All Networked locations.
  - 7) System interface locations (i.e. TELCO, two way radio, etc.).
  - 8) System trouble reporting.
  - 9) System Electrical Supervision.
  - 10)UPS operation.
  - 11)STRs.
  - 12)NSs
  - 13)TCOs.
4. The Contractor shall provide four (4) copies of the recorded system pretest measurements and the written certification that the System is ready for the formal acceptance test shall be submitted to the RE.

**C. Acceptance Test:**

1. After the PA System has been pretested and the Contractor has submitted the pretest results and certification to the RE, then the Contractor shall schedule an acceptance test date and give the RE 30 day's written notice prior to the date the acceptance test is expected to begin. The System shall be tested in the presence of TVE 0050P3B and an OEM certified representatives. The System shall be tested utilizing the approved test equipment to certify proof of performance and Emergency / Public Safety compliance. The tests shall verify that the total System meets all the requirements of this specification. The notification of the acceptance test shall include the expected length (in time) of the test.
2. The acceptance test shall be performed on a "go-no-go" basis. Only those operator adjustments required to show proof of performance shall be allowed. The test shall demonstrate and verify that the installed System does comply with all requirements of this specification under operating conditions. The System shall be rated

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as either acceptable or unacceptable at the conclusion of the test. Failure of any part of the System that precludes completion of system testing, and which cannot be repaired in four (4) hours, shall be cause for terminating the acceptance test of the System. Repeated failures that result in a cumulative time of eight (8) hours to affect repairs shall cause the entire System to be declared unacceptable. Retesting of the entire System shall be rescheduled at the convenience of the Government.

3. Retesting of the entire System shall be rescheduled at the convenience of the Government and costs borne by the Contractor at the direction of the SRE.

**D. Acceptance Test Procedure:**

**1. Physical and Mechanical Inspection:**

- a. The TVE 0050P3B Representative will tour all areas where the PA system and all sub-systems are completely and properly installed to insure they are operationally ready for proof of performance testing. A system inventory including available spare parts will be taken at this time. Each item of installed equipment shall be checked to ensure appropriate UL certification labels are affixed.
- b. The System diagrams, record drawings, equipment manuals, TIP Auto CAD Disks, intermediate, and pretest results shall be formally inventoried and reviewed.
- c. Failure of the System to meet the installation requirements of this specification shall be grounds for terminating all testing.
- d. Demonstrate operational system to customer by walking the space.
- e. Demonstrate functionality of the system to the customer or customer's representative.
- f. Provide training to customer employee to maintain system as required.
- g. Occupancy Adjustments: When requested within 12 months of date of substantial completion manufacturer is to provide on site assistance in adjusting system to suit actual occupied conditions. Provide one visit to site outside normal occupancy hours for this purpose without additional cost to the VAMC.

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2. Operational Test:

- a. After the Physical and Mechanical Inspection, the system head end equipment shall be checked to verify that it meets all performance requirements outlined herein. A spectrum analyzer and sound level meter may be utilized to accomplish this requirement.
- b. Following the head end equipment test, each speaker (or on board speaker) shall be inspected to ensure there are no signal distortions such as intermodulation, data noise, popping sounds, erratic system functions, on any function.
- c. The distribution system shall be checked at each interface, junction, and distribution point, first, middle, and last speaker in each leg to verify the PA distribution system meets all system performance standards.
- d. If the RED system is a part of the system, each volume stepper switches shall be checked to insure proper operation of the pillow speaker, the volume stepper and the RED system (if installed).
- e. Additionally, each installed head end equipment, microphone console; amplifier, mixer, distributed speaker/amplifier, monitor speaker, telephone interface, power supply and remote amplifiers shall be checked insuring they meet the requirements of this specification.
- f. Once these tests have been completed, each installed sub-system function shall be tested as a unified, functioning and fully operating system. The typical functions are: "all call," three sub-zoned, minimum of 15 minutes of UPS operation, electrical supervision, trouble panel, corridor speakers and audio paging.
- g. Individual Item Test: The TVE 0050P3B Representative will select individual items of equipment for detailed proof of performance testing until 100% of the System has been tested and found to meet the contents of this specification. Each item shall meet or exceed the minimum requirements of this document.
- h. At the completion of installation initial tests and adjustment are to be performed in accordance with specified spacing and orientation, tests be conducted in an open area of 35 ft. x 35 ft. minimum size. Tests shall indicate that all acoustical performance requirements described herein are satisfied.

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- i. Verify that masking and paging zoning levels are appropriate and as per plan.
- j. All testing and adjusting of the system shall be accomplished in the absence of the eventual occupants whenever possible. These precautions are essential to insure that the attention of the occupants will not be unnecessarily drawn to the noise or to its source. Test area for consistency of masking volume and quality.
  1. Tests and adjustments shall include the testing of:
    - a) Hum and Noise Level
    - b) Loudspeaker Operation
    - c) Freedom from Buzzes, Rattles and Objectionable Distortion
    - d) Gain Control Settings
- k. The manufacturers' agent with the support and cooperation of any Subcontractor installer shall perform the acceptance testing of the completed installation. These tests shall be performed to demonstrate that the equipment is fully furnished and installed in compliance with the terms of the Specifications in all Contract Documents. Except as otherwise specified, the Manufacturer or Subcontractor shall provide all instruments, equipment, labor and materials necessary to complete these tests.
- l. Manufacturers Field Service: Engage a factory authorized service representative to inspect field assembled components and equipment installation and connections. Report results in writing. Include the following.
  1. Operational Test: Start system to confirm proper operation. Remove malfunctioning units, replace with new units and retest. Make initial sound spectrum and level adjustments for each zone.
  2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
  3. Inspection: Verify that units and controls are properly labeled and interconnecting wires and terminals are identified.
  4. Sound Masking Power Level Adjustments: Adjust independently for each space to minimum level of 47dBA, unless otherwise noted on the plan, to ensure speech privacy between adjacent workstations while complying with other system requirements.

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- m. The Subcontractor shall project the completion date of tests and adjustments so that he can give a minimum of one week's notice to the active Project Manager.
- n. Measurements of system performance shall be made using a calibrated ANSI precision sound level meter set for "slow" meter damping and 'A' scale filtering. The measurements shall be made at not less than twenty test positions at 4' height above the floor level, with gain adjusted to provide the system design level. All interior finishes and furnishings shall be in place. Tests shall be for each floor at times not occupied by personnel.
- o. Final Acceptance Testing:
  - 1. Instrumentation: Use a professional quality sound level meter in accordance with ANSI S1.4
  - 2. Record test observations, readings and corrective actions.
  - 3. System Tests: Include the following for each zone:
  - 4. Relative Sound Pressure Level

Band	Open Plan Areas	Enclosed Offices
200	+2.5	-2
250	+3	-2
315	+2	-2.5
400	+1	-3
500	0	-4
630	-1	-5
800	-2	-6
1000	-3	-7
1250	-4	-8.5
1600	-5	-10
2000	-6	-12

- p. Adjust level of masking sound for each space so one third octave band centered at 500 Hz has final selected sound power level for that space. Measure deviation from listed values in one-third octave bands from 400 to 2000Hz. Measured values must not deviate from those listed by more than 4 dB for open plan areas and 8dB for enclosed offices. The total of individual band deviations in eight bands must not exceed 16 dB for open plan areas and 30 dB for enclosed offices.

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- q. Walk Through Test: People in masked spaces cannot discern speaker locations.
  - r. Temporal Stability Test: Check for uniformity of time by measuring sound level in each of 11 octave bands at one-minute intervals over a 30-minute test period. Deviations must not exceed limits specified.
  - s. Retest: Correct deficiencies identified by tests and observations and retest until meeting specified requirements.
  - t. Recording Control Settings and System Adjustments: Record final control settings and programming and final tap setting of speaker matching transformers. Record final sound level measurements and observations.
  - u. A written report representing the results of the above tests, including numerical values where applicable, shall be submitted for review.
3. Test Conclusion:
- a. At the conclusion of the Acceptance Test, using the generated punch list (or discrepancy list) the VA and the Contractor shall jointly agree to the results of the test, and reschedule testing on deficiencies and shortages with the RE. Any retesting to comply with these specifications will be done at the Contractor's expense.
  - b. If the System is declared unacceptable without conditions, all rescheduled testing expenses will be borne by the Contractor.
- E. Acceptable Test Equipment: The test equipment shall be furnished by the Contractor shall have a calibration tag of an acceptable calibration service dated not more than 12 months prior to the test. As part of the submittal, a test equipment list shall be furnished that includes the make and model number of the following type of equipment as a minimum:
- 1. Spectrum Analyzer.
  - 2. Signal Level Meter.
  - 3. Volt-Ohm Meter.
  - 4. Sound Pressure Level (SPL) Meter.
  - 5. Oscilloscope.
  - 6. Random Noise Generator.
  - 7. Audio Amplifier with External Speaker.



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4.2 WARRANTY

A. Comply with FAR 52.246-21, except that warranty shall be as follows:

B. Contractor's Responsibility:

1. The Contractor shall warranty that all provided material and equipment will be free from defects, workmanship and will remain so for a period of two (2) years from date of final acceptance of the System by the VA. The Contractor shall provide OEM's equipment warranty documents, to the RE (or Facility Contracting Officer if the Facility has taken possession of the building), that certifies each item of equipment installed conforms to OEM published specifications.
2. The Contractor's maintenance personnel shall have the ability to contact the Contractor and OEM for emergency maintenance and logistic assistance, remote diagnostic testing, and assistance in resolving technical problems at any time. This contact capability shall be provided by the Contractor and OEM at no additional cost to the VA.
3. All Contractor maintenance and supervisor personnel shall be fully qualified by the OEM and must provide two (2) copies of current and qualified OEM training certificates and OEM certification upon request.
4. Additionally, the Contractor shall accomplish the following minimum requirements during the two year guaranty period:
  - a. Response Time During the **Two Year** Guaranty Period:
    - 1) The RE (or Facility Contracting Officer if the system has been turned over to the Facility) is the Contractor's ONLY OFFICIAL reporting and contact official for nurse call system trouble calls, during the guaranty period.
    - 2) A standard work week is considered 8:00 A.M. to 5:00 P.M. or as designated by the RE (or Facility Contracting Officer), Monday through Friday exclusive of Federal Holidays.
    - 3) The Contractor shall respond and correct on-site trouble calls, during the standard work week to:
      - a) A routine trouble call within one (1) working day of its report. A routine trouble is considered a trouble which causes a power supply; one (1) master System control station, microphone console or amplifier to be inoperable.

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- b) Routine trouble calls in critical emergency health care facilities (i.e., cardiac arrest, intensive care units, etc.) shall also be deemed as an emergency trouble call. The RE (or Facility Contracting Officer) shall notify the Contractor of this type of trouble call.
  - c) An emergency trouble call within four (4) hours of its report. An emergency trouble is considered a trouble which causes a sub-zone, zone, distribution point, terminal cabinet, or all call system to be inoperable at any time.
  - 4) If a PA System component failure cannot be corrected within four (4) hours (exclusive of the standard work time limits), the Contractor shall be responsible for providing alternate System equipment. The alternate equipment/system shall be operational within a maximum of 12 hours after the four (4) hour trouble shooting time and restore the effected location operation to meet the System performance standards. If any sub-system or major system trouble cannot be corrected within one working day, the Contractor shall furnish and install compatible substitute equipment returning the System or sub-system to full operational capability, as described herein, until repairs are complete.
- b. Required On-Site Visits During the Two Year Guaranty Period
- 1) The Contractor shall visit, on-site, for a minimum of eight (8) hours, once every 12 weeks, during the guaranty period, to perform system preventive maintenance, equipment cleaning, and operational adjustments to maintain the System according the descriptions identified in this document.
  - 2) The Contractor shall arrange all Facility visits with the RE (or Facility Contracting Officer) prior to performing the required maintenance visits.
  - 3) Preventive maintenance procedure(s) shall be performed by the Contractor in accordance with the OEM's recommended practice and service intervals during non-busy time agreed to by the RE (or Facility Contracting Officer) and Contractor.
  - 4) The preventive maintenance schedule, functions and reports shall be provided to and approved by the RE (or Facility Contracting Officer).

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- 5) The Contractor shall provide the RE (or Facility Contracting Officer) a type written report itemizing each deficiency found and the corrective action performed during each required visit or official reported trouble call. The Contractor shall provide the RE with sample copies of these reports for review and approval at the beginning of the Acceptance Test. The following reports are the minimum required:
    - a) The Contractor shall provide a monthly summary all equipment and sub-systems serviced during this warranty period to RE (or Facility Contracting Officer) by the fifth (5<sup>th</sup>) working day after the end of each month. The report shall clearly and concisely describe the services rendered, parts replaced and repairs performed. The report shall prescribe anticipated future needs of the equipment and systems for preventive and predictive maintenance.
    - b) The Contractor shall maintain a separate log entry for each item of equipment and each sub-system of the System. The log shall list dates and times of all scheduled, routine, and emergency calls. Each emergency call shall be described with details of the nature and causes of emergency steps taken to rectify the situation and specific recommendations to avoid such conditions in the future.
  - 6) The RE (or Facility Contracting Officer) shall convey to the Facility Engineering Officer, two (2) copies of actual reports for evaluation.
    - a) The RE (or Facility Contracting Officer) shall ensure a copy of these reports is entered into the System's official acquisition documents.
    - b) The Facility Chief Engineer shall ensure a copy of these reports is entered into the System's official technical record documents.
- C. Work Not Included: Maintenance and repair service shall not include the performance of any work due to improper use; accidents; other vendor, contractor, or VAMC tampering or negligence, for which the Contractor is not directly responsible and does not control. The Contractor shall immediately notify the RE or Facility Contracting Officer in writing upon the discovery of these incidents. The RE or Facility Contracting

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Officer will investigate all reported incidents and render an official opinion in writing concerning the supplied information.

**4.3 TRAINING**

- A. Provide thorough training of all biomed engineering and electronic technical staff assigned to those nursing units receiving new networked nurse/patient communications equipment. This training shall be developed and implemented to address two different types of staff. Floor nurses/staff shall receive training from their perspective, and likewise, unit secretaries (or any person whose specific responsibilities include answering patient calls and dispatching staff) shall receive operational training from their perspective. A separate training room will be set up that allows this type of individualized training utilizing in-service training unit, prior to cut over of the new system.
- B. Provide the following minimum training times and durations:
  - 1. **48** hours prior to opening for BME / Electronic Staff (in 8-hour increments) - split evenly over 3 weeks and day and night shifts. Coordinate schedule with Resident Engineer.
  - 2. 32 hours during the opening week for Telephone Staff - both day and night shifts.
  - 3. **24** hours for supervisors and system administrators.

- - - E N D - - -

SECTION 27 52 23  
NURSE CALL AND CODE BLUE SYSTEMS

PART 1 - GENERAL

1.1 SECTION SUMMARY

- A. Work covered by this document includes design, engineering, labor, material and products, equipment warranty and system warranty, training and services for, and incidental to, the complete installation of new and fully operating National Fire Protection Association (NFPA) - Life Safety Code 101.3-2 (a) Labeled and (b) Listed, Emergency Service Nurse-Call and/or Life Safety listed Code Blue Communication System and associated equipment (here-in-after referred to as the System) provided in approved locations indicated on the contract drawings. These items shall be tested and certified capable of receiving, distributing, interconnecting and supporting Nurse-Call and/or Code Blue communications signals generated local and remotely as detailed herein.
- B. Work shall be complete, Occupational Safety and Health Administration (OSHA), National Recognized Testing Laboratory (NRTL - i.e. Underwriters Laboratory [UL]) Listed and Labeled; and VA Central Office (VACO), Telecommunications Voice Engineering (TVE 0050P3B) tested, certified and ready for operation.
- C. The System shall be delivered free of engineering, manufacturing, installation, and functional defects. It shall be designed, engineered and installed for ease of operation, maintenance, and testing.
- D. The term "provide", as used herein, shall be defined as: designed, engineered, furnished, installed, certified, tested, and warranty by the Contractor.
- E. Specification Order of Precedence: In the event of a conflict between the text of this document and the Project's Contract Drawings outlined and/or cited herein; **THE TEXT OF THIS DOCUMENT TAKES PRECEDENCE.** *HOWEVER, NOTHING IN THIS DOCUMENT WILL SUPERSEDE APPLICABLE EMERGENCY LAWS AND REGULATIONS, SPECIFICALLY NATIONAL AND/OR LOCAL LIFE AND PUBLIC SAFETY CODES.* The Local Fire Marshall and/or VA Public Safety Officer are the only authorities that may modify this document's EMERGENCY CODE COMPLIANCE REQUIREMENTS, on a case by case basis, in writing and confirmed by VA's Project Manager (PM), Resident Engineer (RE) and TVE-0050P3B. The VA PM is the only approving authority for other amendments to this document that may be granted, on a case by

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case basis, in writhing with technical concurrencies by VA's PM, RE, TVE-0050P3B and identified Facility Project Personnel.

- F. The Original Equipment Manufacturer (OEM) and Contractor shall ensure that all management, sales, engineering and installation personnel have read and understand the requirements of this specification before the system is designed, engineered, delivered and provided. The Contractor shall furnish a written statement stating this requirement as a part of the technical submittal that includes each name and certification, including the OEMs. The Contractor is cautioned to obtain in writing, all approvals for system changes relating to the published contract specifications and drawings, from the PM and/or the RE before proceeding with the change.

**1.2 RELATED SECTIONS**

- A. 01 33 23 - Shop Drawings, Product Data and Samples.
- B. 07 84 00 - Firestopping.
- C. 26 05 21 - Low - Voltage Electrical Power Conductors and Cables (600 Volts and Below).
- D. 26 41 00 - Facility Lightning Protection.
- E. 27 05 11 - Requirements for Communications Installations.
- F. 27 05 26 - Grounding and Bonding for Communications Systems.
- G. 27 05 33 - Raceways and Boxes for Communications Systems.
- H. 27 10 00 - TIP Structured Communications Systems Cabling.
- I. 27 11 00 - TIP Communications Interface and Equipment Rooms Fittings.
- J. 27 15 00 - TIP Communications Horizontal and Vertical Cabling.
- // J. 27 15 00.61 / 71 - Radio Entertainment Equipment and System; and/or Extension. //
- // K. 27 41 31 / 41 - Master Antenna Television Equipment and Systems and/or Extension. //
- // L. 27 51 16 - Public Address & Mass Notification System (PA). //
- //M. 27 52 31 - Physical Security Management Equipment and System.//
- // N. 10 25 13 - Patient Bed Service Walls. //

**1.3 DEFINITION**

- A. Provide: Design, engineer, furnish, install, connect complete, test, certify and warranty.
- B. Work: Materials furnished and completely installed.
- C. Review of contract drawings: A service by the engineer to reduce the possibility of materials being ordered which do not comply with

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contract documents. The engineer's review shall not relieve the Contractor of responsibility for dimensions or compliance with the contract documents. The reviewer's failure to detect an error does not constitute permission for the Contractor to proceed in error.

- D. Headquarters (aka VACO) Technical Review, for National and VA Communications and Security, Codes, Frequency Licensing Standards, Guidelines and Compliance:

Office of Telecommunications  
Special Communications Team (0050P3B)  
1335 East West Highway - 3rd Floor  
Silver Spring, Maryland 20910,  
(O) 301-734-0350, (F) 301-734-0360

E. Engineer:    // XXXXXXXX //  
                  // XXXXXXXX //  
                  // XXXXXXXX //  
                  // XXXXXXXX //  
                  // XXXXXXXX //

F. Owner:        // XXXXXXXX //

G. General Contractor (GC): // XXXXXXXX //

H. Contractor: Systems Contractor; you; successful bidder.

**1.4 REFERENCES**

- A. The installation shall comply fully with all governing authorities, laws and ordinances, regulations, codes and standards, including, but not limited to:

1. United States Federal Law:

a. Departments of:

1) Commerce, Consolidated Federal Regulations (CFR), Title 15 - Under the Information Technology Management Reform Act (Public Law 104-106), the Secretary of Commerce approves standards and guidelines that are developed by the:

a) Chapter II, National Institute of Standards Technology (NIST - formerly the National Bureau of Standards). Under Section 5131 of the Information Technology Management Reform Act of 1996 and the Federal Information Security Management Act of 2002 (Public Law 107-347), NIST develops - Federal Information Processing Standards Publication

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(FIPS) 140-2—Security Requirements for Cryptographic Modules.

- b) Chapter XXIII, National Telecommunications and Information Administration (NTIA - aka 'Red Book') Chapter 7.8 / 9; CFR, Title 47 Federal communications Commission (FCC) Part 15, Radio Frequency Restriction of Use and Compliance in "Safety of Life" Functions & Locations.
- 2) FCC - Communications Act of 1934, as amended, CFR, Title 47 - Telecommunications, in addition to Part 15 - Restrictions of use for Part 15 listed Radio Equipment in Safety of Life / Emergency Functions / Equipment/ Locations (also see CFR, Title 15 - Department of Commerce, Chapter XXIII - NTIA):
  - a) Part 15 - Restrictions of use for Part 15 listed Radio Equipment in Safety of Life / Emergency Functions / Equipment/Locations.
  - b) Part 58 - Television Broadcast Service.
  - c) Part 90 - Rules and Regulations, Appendix C.
- 3) Health, (Public Law 96-88), CFR, Title 42, Chapter IV Health & Human Services, CFR, Title 46, Subpart 1395(a)(b) JCAHO "a hospital that meets JCAHO accreditation is deemed to meet the Medicare conditions of Participation by meeting Federal Directives:"
  - a) All guidelines for Life, Personal and Public Safety; and, Essential and Emergency Communications.
- 4) Labor, CFR, Title 29, Part 1910, Chapter XVII - Occupational Safety and Health Administration (OSHA), Occupational Safety and Health Standard:
  - a) Subpart 7 - Definition and requirements (for a NRTL - 15 Laboratory's, for complete list, contact ([http://www.osha.gov/dts/otpca/nrtl/faq\\_nrtl.html](http://www.osha.gov/dts/otpca/nrtl/faq_nrtl.html))):
    - 1) UL:
      - a) 44-02 - Standard for Thermoset-Insulated Wires and Cables.
      - b) 65 - Standard for Wired Cabinets.
      - c) 83-03 - Standard for Thermoplastic-Insulated Wires and Cables.
      - d) 467-01 - Standard for Electrical Grounding and



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Bonding Equipment

- e) 468 - Standard for Grounding and Bonding Equipment.
- f) 486A-01 - Standard for Wire Connectors and Soldering Lugs for Use with Copper Conductors
- g) 486C-02 - Standard for Splicing Wire Connectors.
- h) 486D-02 - Standard for Insulated Wire Connector Systems for Underground Use or in Damp or Wet Locations.
- i) 486E-00 - Standard for Equipment Wiring Terminals for Use with Aluminum and/or Copper Conductors.
- j) 493-01 - Standard for Thermoplastic-Insulated Underground Feeder and Branch Circuit Cable.
- k) 514B-02 - Standard for Fittings for Cable and Conduit.
- l) 1069 - Hospital Signaling and Nurse Call Equipment.
- m) 1449 - Standard for Transient Voltage Surge Suppressors.
- n) 1479-03 - Standard for Fire Tests of Through-Penetration Fire Stops.
- o) 1666 - Standard for Wire/Cable Vertical (Riser) Tray Flame Tests.
- p) 1863 - Standard for Safety, Communications Circuits Accessories.
- q) 2024 - Standard for Optical Fiber Raceways.
- r) 60950-1/2 - Information Technology Equipment - Safety.
- 2) Canadian Standards Association (CSA): same tests as for UL.
- 3) Communications Certifications Laboratory (CCL): same tests as for UL.
- 4) Intertek Testing Services NA, Inc. (ITSNA formerly Edison Testing Laboratory [ETL]): same tests as for UL.
- b) Subpart 35 - Compliance with NFPA 101 - Life Safety Code.
- c) Subpart 36 - Design and construction requirements for exit routes.
- d) Subpart 268 - Telecommunications.

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- e) Subpart 305 - Wiring methods, components, and equipment for general use.
- 5) Department of Transportation, CFR, Title 49 (Public Law 89-670), Part 1, Subpart C - Federal Aviation Administration (FAA):
  - a) Standards AC 110/460-ID & AC 707 / 460-2E - Advisory Circulars for Construction of Antenna Towers.
  - b) Forms 7450 and 7460-2 - Antenna Construction Registration.
- 6) Veterans Affairs (Public Law No. 100-527), CFR, Title 38, Volumes I & II:
  - a) Office of Telecommunications:
    - 1) Handbook 6100 - Telecommunications.
      - a) Spectrum Management FCC & NTIA Radio Frequency Compliance and Licensing Program.
      - b) Special Communications Proof of Performance Testing, VACO Compliance and Life Safety Certification(s).
  - b) Office of Cyber and Information Security (OCIS):
    - 1) Handbook 6500 - Information Security Program.
    - 2) Wireless and Handheld Device Security Guideline Version 3.2, August 15, 2005.
  - c) VA's National Center for Patient Safety - Veterans Health Administration Warning System, Failure of Medical Alarm Systems using Paging Technology to Notify Clinical Staff, July 2004.
  - d) VA's Center for Engineering Occupational Safety and Health, concurrence with warning identified in VA Directive 7700.
  - e) Office of Construction and Facilities Management (CFM):
    - 1) Master Construction Specifications (PG-18-1).
    - 2) Standard Detail and CAD Standards (PG-18-4).
    - 3) Equipment Guide List (PG-18-5).
    - 4) Electrical Design Manual for VA Facilities (PG 18-10), Articles 7 & 8.
  - 5) Minimum Requirements of A/E Submissions (PG 18-15):
    - a) Volume B, Major New Facilities, Major Additions; and Major Renovations, Article VI, Paragraph B.
    - b) Volume C - Minor and NRM Projects, Article III, Paragraph S.

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- c) Volume E - Request for Proposals Design/Build Projects, Article II, Paragraph F.
- 6) Mission Critical Facilities Design Manual (Final Draft - 2007).
- 7) Life Safety Protected Design Manual (Final Draft - 2007).
- 8) Solicitation for Offerors (SFO) for Lease Based Clinics - (05-2009).
- b. Federal Specifications (Fed. Specs.):
  - 1) A-A-59544-00 - Cable and Wire, Electrical (Power, Fixed Installation).
- 2. National Codes:
  - a. American Institute of Architects (AIA): Guidelines for Healthcare Facilities.
  - b. American National Standards Institute/Electronic Industries Association/Telecommunications Industry Association (ANSI/EIA/TIA):
    - 1) 568-B - Commercial Building Telecommunications Wiring Standards:
      - a) B-1 - General Requirements.
      - b) B-2 - Balanced twisted-pair cable systems.
      - c) B-3 - Fiber optic cable systems.
    - 2) 569 - Commercial Building Standard for Telecommunications Pathways and Spaces.
    - 3) 606 - Administration Standard for the Telecommunications Infrastructure of Communications Buildings.
    - 4) 607 - Commercial Building Grounding and Bonding Requirements for Telecommunications.
    - 5) REC 127-49 - Power Supplies.
    - 6) RS 270 - Tools, Crimping, Solderless Wiring Devices, Recommended Procedures for User Certification.
  - c. American Society of Mechanical Engineers (ASME):
    - 1) Standard 17.4 - Guide for Emergency Personnel.
    - 2) Standard 17.5 - Elevator & Escalator Equipment (prohibition of installing non-elevator equipment in Elevator Equipment Room / Mechanical Penthouse).
  - d. American Society of Testing Material (ASTM):

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- 1) D2301-04 - Standard Specification for Vinyl Chloride Plastic Pressure Sensitive Electrical Insulating Tape.
- e. Building Industries Communications Services Installation (BICSI):
  - 1) All standards for smart building wiring, connections and devices for commercial and medical facilities.
  - 2) Structured Building Cable Topologies.
  - 3) In consort with ANSI/EIA/TIA.
- f. Institute of Electrical and Electronics Engineers (IEEE):
  - 1) SO/TR 21730:2007 - Use of mobile wireless communication and computing technology in healthcare facilities - Recommendations for electromagnetic compatibility (management of unintentional electromagnetic interference) with medical devices.
  - 2) 0739-5175/08/©2008 IEEE - Medical Grade - Mission Critical - Wireless Networks.
  - 3) C62.41 - Surge Voltages in Low-Voltage AC Power Circuits.
- g. NFPA:
  - 1) 70 - National Electrical Code (current date of issue) - Articles 517, 645 & 800.
  - 2) 75 - Standard for Protection of Electronic Computer Data-Processing Equipment.
  - 3) 77 - Recommended Practice on Static Electricity.
  - 4) 99 - Healthcare Facilities.
  - 5) 101 - Life Safety Code.
3. State Hospital Code(s).
4. Local Town, City and/or County Codes.
5. Accreditation Organization(s):
  - a. Joint Commission on Accreditation of Hospitals Organization (JCAHO) - Section VI, Part 3a - Operating Features.

**1.5 QUALIFICATIONS**

- A. The OEM shall have had experience with three (3) or more installations of Nurse Call systems of comparable size and interfacing complexity with regards to type and design as specified herein. Each of these installations shall have performed satisfactorily for at least one (1) year after final acceptance by the user. Include the names, locations and point of contact for these installations as a part of the submittal.

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- B. The Contractor shall submit certified documentation that they have been an authorized distributor and service organization for the OEM for a minimum of three (3) years. The Contractor shall be authorized by the OEM to pass thru the OEM's warranty of the installed equipment to VA. In addition, the OEM and Contractor shall accept complete responsibility for the design, installation, certification, operation, and physical support for the System. This documentation, along with the System Contractor and OEM certifications must be provided in writing as part of the Contractor's Technical submittal.
- C. The Contractor's Communications Technicians assigned to the System shall be fully trained, qualified, and certified by the OEM on the engineering, installation, operation, and testing of the System. The Contractor shall provide formal written evidence of current OEM certification(s) for the installer(s) as a part of the submittal or to the RE before being allowed to commence work on the System.
- D. The Contractor shall display all applicable national, state and local licenses.
- E. The Contractor shall submit copy (s) of Certificate of successful completion of OEM's installation/training school for installing technicians of the System's Nurse Call and/or Code Blue equipment being proposed.

**1.6 CODES AND PERMITS**

- A. Provide all necessary permits and schedule all inspections as identified in the contract's milestone chart, so that the system is proof of performance tested, certified and approved by VA and ready for operation on a date directed by the Owner.
- B. The contractor is responsible to adhere to all codes described herein and associated contractual, state and local codes.

**1.7 SCHEDULING**

- A. After the award of contract, the Contractor shall prepare a detailed schedule (aka milestone chart) using "Microsoft Project" software or equivalent. The Contractor Project Schedule (CPS) shall indicate detailed activities for the projected life of the project. The CPS shall consist of detailed activities and their restraining relationships. It will also detail manpower usage throughout the project.

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- B. It is the responsibility of the Contractor to coordinate all work with the other trades for scheduling, rough-in, and finishing all work specified. The owner will not be liable for any additional costs due to missed dates or poor coordination of the supplying contractor with other trades.

**1.8 REVIEW OF CONTRACT DRAWINGS AND EQUIPMENT DATA SUBMITTALS (AKA TECHNICAL SUBMITTAL[S])**

(Note: The Contractor is encouraged, but not required, to submit separate technical submittal(s) outlining alternate technical approach(s) to the system requirements stated here-in as long as each alternate technical document(s) is complete, separate, and submitted in precisely the same manner as outlined herein. VA will review and rate each received alternate submittal, which follows this requirement, in exactly the same procedure as outlined herein. Partial, add-on, or addenda type alternates will not be accepted or reviewed.)

- A. Submit at one time within 10 days of contract awarding, drawings and product data on all proposed equipment and system. Check for compliance with contract documents and certify compliance with Contractor's "APPROVED" stamp and signature.
- B. Support all submittals with descriptive materials, i.e., catalog sheets, product data sheets, diagrams, and charts published by the manufacturer. These materials shall show conformance to specification and drawing requirements.
- C. Where multiple products are listed on a single cut-sheet, circle or highlight the one that you propose to use. Provide a complete and through equipment list of equipment expected to be installed in the system, with spares, as a part of the submittal. Special Communications (TVE-0050P3B) will not review any submittal that does not have this list.
- D. Provide four (4) copies to the PM for technical review. The PM will provide a copy to the offices identified in Paragraph 1.3.C & D, at a minimum for compliance review as described herein where each responsible individual(s) shall respond to the PM within 10 days of receipt of their acceptance or rejection of the submittal(s).
- E. Provide interconnection methods, conduit (where not already installed), junction boxes (J-Boxes), cable, interface fixtures and equipment lists for the: ENR(s) ( aka DMARC), TER, TCR, MCR, MCOR, PCR, ECR, Stacked Telecommunications Rooms (STR), Nurses Stations (NS), Head End Room

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(HER), Head End Cabinet (HEC), Head End Interface Cabinet (HEIC) and approved TCO locations TIP interface distribution layout drawing, as they are to be installed and interconnected to teach other (REFER TO APPENDIX B - SUGGESTED TELECOMMUNI-CAITONS ONE LINE TOPOLOGY pull-out drawing).

- F. Equipment technical literature detailing the electrical and technical characteristics of each item of equipment to be furnished.
- G. Engineering drawings of the System, showing calculated of expected signal levels at the headend input and output, each input and output distribution point, and signal level at each telecommunications outlet.
- H. Surveys Required as a Part of The Technical Submittal:
  - 1. The Contractor shall provide the following System surveys that depict various system features and capacities required in addition to the on-site survey requirements described herein (see Specification Paragraph 2.4.3). Each survey shall be in writing and contain the following information (the formats are suggestions and may be used for the initial Technical Submittal Survey requirements), as a minimum:
    - a. Nurse Call Cable System Design Plan:
      - 1) An OEM and contractor designed functioning Nurse Call System cable plan **to populate the entire TIP empty conduit/pathway distribution systems provided as a part of Specification 27 11 00** shall be provided as a part of the technical proposal. A specific functioning Nurse Call: cable, interfaces, J-boxes and back boxes shall coincide with the total growth items as described herein. It is the Contractor's responsibility to provide the Systems' entire Nurse Call cable and accessory requirements and engineer a functioning Nurse Call distribution system and equipment requirement plan of the following paragraph(s), at a minimum:
      - 2) The required Nurse Call and/or Code Blue Equipment Locations:

<u>EQUIPPED ITEM</u>	<u>CAPACITY</u>	<u>GROWTH</u>
Master Stations		
Dome Lights		
Room		
Corridor		

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<u>EQUIPPED ITEM</u>	<u>CAPACITY</u>	<u>GROWTH</u>
Other		
Patient Stations		
Single		
Dual		
Isolation		
Other		
Emergency Stations		
Bath		
Toilet		
Isolation		
Other		
Staff Stations		
Duty Stations		
Code Blue		
Patient Locations		
Surgical Recovery Locations		
Medical Recovery Locations		
ICU Locations		
SICU		
MICU		
CCU		
Other		
Emergency Room Locations		
Other		
Supervisory Locations		
Nurse Stations		
On-Call Rooms		
Other		
Remote Locations		
Telephone Operator's Room		
Police Control Room		
Other		
Radio Paging Access (when pre-approved by TVE-0050P3B)		



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<u>EQUIPPED ITEM</u>	<u>CAPACITY</u>	<u>GROWTH</u>
Audio Paging Access (when pre-approved by TVE-0050P3B)		
Wireless Access (when pre-approved by TVE-0050P3B)		
Maintenance/Programming Console		
Location(s)		
Central Control Cabinet/Equipment		
Location		
Power Supply(s)		
UPS(s)		

3) The required Nurse Call and/or Code Blue Cable  
 Plant/Connections:

The Contractor shall clearly and fully indicate this category for each item identified herein as a part of the technical submittal. For this purpose, the following definitions and sample connections are provided to detail the system's capability:

<u>EQUIPPED ITEM</u>	<u>CAPACITY</u>	<u>GROWTH</u>
Central Control Cabinet/Equipment		
Location		
Power Supply(s)		
UPS(s)		
Essential Electrical Power Panel(s)		
Other		
Cable Plant		
Supply to Locations Identified in Paragraph 1.8.H.1.a.2)		
Remote Locations		
Telephone Operator Room		
Police Control Room		
Other		
Maintenance/Program Console		
Location(s)		
Other		
LAN (Local Facility) Access/Equipment/Location (when pre-		

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<u>EQUIPPED ITEM</u>	<u>CAPACITY</u>	<u>GROWTH</u>
approved by TVE-0050P3B)		
Wireless Access/Equipment/Location (when pre-approved by TVE-0050P3B)		
PA Access/Equipment/Location (when pre- approved by TVE-0050P3B)		
Other		

**1.9 PROJECT RECORD DOCUMENTS (AS BUILTS)**

- A. Throughout progress of the Work, maintain an accurate record of changes in Contract Documents. Upon completion of Work, transfer recorded changes to a set of Project Record Documents.
- B. The floorplans shall be marked in pen to include the following:
  1. Each device specific locations with UL labels affixed.
  2. Conduit locations.
  3. Each interface and equipment specific location.
  4. Head-end equipment and specific location.
  5. Wiring diagram.
  6. Labeling and administration documentation.
  7. Warranty certificate.
  8. System test results.

**1.10 WARRANTIES / GUARANTY**

- A. The Contractor shall warrant the installation to be free from defect in material and workmanship for a period of two (2) years from the date of acceptance of the project by the owner. The Contractor shall agree to remedy covered defects within four (4) hours of notification of major failures or within twenty-four (24) hours of notification for individual station related problems.
- B. The Contractor shall agree to grantee the system according to the guidelines outlined in Article 4 herein.

**1.11 USE OF THE SITE**

- A. Use of the site shall be at the GC's direction.
- B. Coordinate with the GC for lay-down areas for product storage and administration areas.
- C. Coordinate work with the GC and their sub-contractors.
- D. Access to buildings wherein the work is performed shall be directed by the GC.

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**1.12 DELIVERY, STORAGE, AND HANDLING**

- A. Deliver, store, and handle products using means and methods that will prevent damage, deterioration, and loss, including theft.
- B. Store products in original containers.
- C. Coordinate with the GC for product storage. There may be little or no storage space available on site. Plan to potentially store materials off site.
- D. Do not install damaged products. Remove damaged products from the site and replaced with new product at no cost to the Owner.

**1.13 PROJECT CLOSE-OUT**

- A. Prior to final inspection and acceptance of the work, remove all debris, rubbish, waste material, tools, construction equipment, machinery and surplus materials from the project site and thoroughly clean your work area.
- B. Before the project closeout date, the Contractor shall submit:
  - 1. OEM Equipment Warranty Certificates.
  - 2. Evidence of compliance with requirements of governing authorities such as the Low Voltage Certificate of Inspection.
  - 3. Project record documents.
  - 4. Instruction manuals and software that is a part of the system.
  - 5. System Guaranty Certificate.
- C. Contractor shall submit written notice that:
  - 1. Contract Documents have been reviewed.
  - 2. Project has been inspected for compliance with contract.
  - 3. Work has been completed in accordance with the contract.

**PART 2 - PRODUCTS / FUNCTIONAL REQUIREMENTS**

**2.0 GENERAL REQUIREMENTS FOR EQUIPMENT AND MATERIALS**

- A. Furnish and install a complete and fully functional and operable Nurse Call System for each location shown on the contract drawings and TCOs **WHOSE EMPTY CONDUIT SYSTEM WAS PROVIDED AS A PART OF SPECIFICATION 27 11 00.**
- B. The specific location for each Nurse Call: Central Control Cabinet is // \_\_\_\_\_, // Power Supply is // \_\_\_\_\_, // Electrical Supervisor Panel is // \_\_\_\_\_, // UPS is // \_\_\_\_\_, // Two (2) Remote Annunciation Consoles is // \_\_\_\_\_, // Master Station is // \_\_\_\_\_, // Duty Station is // \_\_\_\_\_, // Staff Station is // \_\_\_\_\_, // Emergency Station is // \_\_\_\_\_, // Dome Light is //

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\_\_\_\_\_,// Code Blue Station is // \_\_\_\_\_, // and TCOs are //  
\_\_\_\_\_ (list locations here AND indicate like locations on the  
contract drawings) //.

- C. Coordinate features and select interface components to form an integrated Nurse Call system. Match components and interconnections between the systems for optimum performance of specified functions.
- D. Expansion Capability: The Nurse Call equipment interfaces and cables shall be able to increase number of enunciation points in the future by a minimum of 50 percent (%) above those indicated without adding any internal or external components or main trunk cable conductors.
- E. Equipment: Active electronic type shall use solid-state components, fully rated for continuous duty unless otherwise indicated. Select equipment for normal operation on input power usually supplied between 110 to 130 VAC, 60 Hz supplied from the Facility's Emergency Electrical Power System.
- F. Meet all FCC requirements regarding equipment listing, low radiation and/or interference of RF signal(s). The system shall be designed to prevent direct pickup of signals from within and outside the building structure.
- G. Weather/Water Proof Equipment: Listed and labeled by an OSHA certified NRTL (i.e. UL) for duty outdoors or in damp locations.

## 2.1 SYSTEM DESCRIPTION

- A. Furnish and install a complete and fully functional and operable Nurse Call and/or Code Blue System **WHOSE EMPTY CONDUIT SYSTEM WAS PROVIDED AS A PART OF SPECIFICATION 27 11 00.**
- B. **The Contractor is responsible for interfacing the // PA // //, MATV // //, RED // //, Patient Bed Service Walls // // and \_\_\_\_\_ // systems with the System.**
- C. The Contractor shall continually employ interfacing methods that are approved by the OEM and VA. At a minimum, an acceptable interfacing method requires not only a physical and mechanical connection, but also a matching of signal, voltage, and processing levels with regard to signal quality and impedance. The interface point must adhere to all standards described herein for the full separation of Critical Care and Life Safety systems.
- D. The System Contractor shall connect the System ensuring that all NFPA and UL Critical Care and Life Safety Circuit and System separation

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guidelines are satisfied. The System Contractor is not allowed to make any connections to the Telephone System. VA shall arrange for the interconnection between the // PA // //, MATV // //, RED // //, Patient Bed Service Walls // // and \_\_\_\_\_ // Systems with the appropriate responsible parties.

- E. System hardware shall consist of a **standalone (separate)** nurse call // **Code Blue** // patient communications network comprised of nurse consoles, control stations, staff and duty stations, room and corridor dome lights, pillow speakers/call cords, pull cord and/or emergency push button stations, wiring. And, other options such as, **pocket page interfaces**, computer interfaces, printer interfaces, wireless / telephone network interfaces, and nurse locating system interface **(when specifically approved first by TVE 0050P3B)** and as shown on drawings. All necessary equipment required to meet the intent of these specifications, whether or not enumerated within these specifications, shall be supplied and installed to provide a complete and operating nurse call // **Code Blue** // patient communications network. **It is not acceptable to utilize the telephone cable system for the control and distribution of nurse call (code Blue) signals and equipment.**
- F. System firmware shall be the product of a reputable firmware OEM of record with a proven history of product reliability and sole control over all source code. Manufacturer shall provide, free of charge, product firmware/software upgrades for a period of two (2) years from date of acceptance by VA for any product feature enhancements. System configuration programming changes shall not require any exchange of parts and shall be capable of being executed remotely via a modem connection **(when specifically approved first by TVE 0050P3B).**
- G. The Nurse Call Head End Equipment shall be located in Telecommunications Room //\_\_\_\_//. **The Nurse Call / Code Blue System may interface the PA system when specifically approved by VA Headquarters T VE 0050P3B during the project approval process prior to contract bidding.**
- H. The System shall utilize microprocessor components for all signaling and programming circuits and functions. Self contained or on board system program memory shall be non-volatile and protected from erasure from power outages for a minimum of 12 hours.

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- I. Provide a backup battery or a UPS for the System (including each distribution cabinet/point, CRT and Monitor) to allow normal operation and function (as if there was no AC power failure) in the event of an AC power failure or during input power fluctuations for a minimum of 30 minutes.
- J. The System is defined as Critical Service and the Code Blue functions is defined as Life Safety/Support by NFPA (re Part 1.1.A) and so evaluated by JCAHCO. **Therefore, the system shall have a minimum of two (2) additional remote enunciation points in order to satisfy NFPA's Life Safety Code 101 (the typical secondary locations are Telephone Operators Room, MAS ER Desk, Boiler Plant, etc; AND the primary location is required to be in the SCC Room //\_\_\_\_//.**
  1. These two (2) additional remote locations shall be fully manned:
    - a. 24/7/365 for certified Hospital **//Clinics// // other \_\_\_\_\_//.**
    - b. As long as other identified VA Medical / Servicing Facilities are open for servicing patients.
    - c. At a minimum, Code Blue Functions shall be provided in all Recovery (Medical and Surgical) Rooms, Intensive Care Units (ICU), Cardiac Care Units (CCU), Step Down Room, Life Support / Monitoring Rooms, Oncology / Radiology Procedure Rooms, Dialysis **// and \_\_\_\_\_ // Areas.**
    - d. The minimum remote enunciation locations shall be:
      - 1) The Telephone / PBX Operator Room.
      - 2) The Police Control / Operations Room.
      - 3) Other location(s) that is specifically approved by VA Headquarters TVE - 0050P3B DURING THE PROJECT DEVELOPMENT STAGES AND PRIOR TO EQUIPMENT PURCHASE.
  2. In addition to the two (2) remote locations afore described, the following locations are the minimum required for additional Nurse Call /Code Blue Annunciation:
    - a. "On Call" Rooms.
    - b. Each Nurse Master Station.
    - c. Each Staff Station.
    - d. Each Duty Station.
    - // e. \_\_\_\_\_ . //**
  3. The MAXIMUM enunciation time period from placement of the Code Blue Call to enunciation at each remote locations is 10 seconds; and, 15

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seconds to the subsequent enunciating media stations (i.e. PA, Radio Paging, Emergency Telephone or Radio Backup, etc.).

- K. Each Code Blue System shall be designed to provide continuous electrical supervision of the complete and entire system (i.e. dome light bulbs [each light will be considered supervised if they use any one or a combination of (UL) approved electrical supervision alternates, as identified in UL-1069, 1992 revision], wires, contact switch connections, circuit boards, data, audio, and communication busses, main and UPS power, etc.). All alarm initiating and signaling circuits shall be supervised for open circuits, short circuits, and system grounds. Main and UPS power circuits shall be supervised for a change in state (i.e. primary to backup, low battery, UPS on line, etc.). When an open, short or ground occurs in any system circuit, an audible and visual fault alarm signal shall be initiated at the nurse control station and all remote locations.
- L. When the System is approved to connect to a separate communications system (i.e. LAN, WAN, Telephone, Public Address, radio raging, wireless systems, etc) the connection point shall meet the following minimum requirements for each hard wired / wireless connection (note each wireless system connection MUST BE APPROVED PRIOR TO CONTRACT BID BY VA HEADQUARTERS TVE - 0050P3B AND SPECTRUM MANAGEMENT - 0050P2B - hereinafter referred to as SM - 0050P2B):
1. UL 60950-1/2.
  2. FIPS 142.
  3. FCC Part 15 Listed Radio Equipment restriction compliance approved by SM - 0050P2B.
- M. All passive distribution equipment shall meet or exceed -80 dB radiation shielding (aka RFI) shielding specifications and be provided with connectors specified by the OEM.
- N. All equipment face plates utilized in the system shall be stainless steel, anodized aluminum or UL approved cyclac plastic for the areas where provided.
- O. Noise filters and surge protectors shall be provided for each equipment interface cabinet, headend cabinet, control console and local and remote amplifier locations to insure protection from input primary AC power surges and to insure noise glitches are not induced into low voltage data circuits.

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- P. Plug-in connectors shall be provided to connect all equipment, except coaxial cables. Coaxial cable distribution points shall use coaxial cable connections recommended by the cable OEM and approved by the system OEM. Base band cable systems shall utilize barrier terminal screw type connectors, at a minimum. As an alternate, crimp type connectors installed with a ratchet type installation tool are acceptable provided the cable dress, pairs, shielding, grounding, connections and labeling are the same as the barrier terminal strip connectors. Tape of any type, wire nuts or solder type connections are unacceptable and will not be approved.
- R. Audio Level Processing: The control equipment shall consist of audio mixer(s), volume limiter(s) and/or compressor(s), and power amplifier(s) to process, adjust, equalize, isolate, filter, and amplify each audio channel for each sub-zone in the system and distribute them into the System's RF interfacing distribution trunks and amplification circuits. It is acceptable to use identified Telephone System cable pairs designated for Two-Way Radio interface and control use or identified as spare telephone cable pairs by the Facility's Telephone System Contractor. The use of telephone cable to distribute RF signals, carrying system or sub-system AC or DC voltage is not acceptable and will not be approved. Additionally, each control location shall be provided with the equipment required to insure the system can produce its designed audio channel capacity at each speaker identified on the contract drawings. The Contractor shall provide: a spare set of telephone paging modules as recommended by the OEM (as a minimum provide one spare module for each installed module); one spare audio power amplifier, one spare audio mixer, one spare audio volume limiter and/or compressor, and one spare audio automatic gain adjusting device, and minimum RF equipment recommended by the OEM.
- S. Contractor is responsible for pricing all accessories and miscellaneous equipment required to form a complete and operating system. Unless otherwise noted in this Part, equipment quantities shall be as indicated on the drawings.
- R. System Performance:
1. At a minimum, each distribution, interconnection, interface, terminating point and TCO shall be capable of supporting the



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Facility's Nurse Call and/or Code Blue System voice and data service as follows:

- a. Shall be compliant with and not degrade the operating parameters of the Public Switched Telephone Network (PSTN) and the Federal Telecommunications System (FTS) at each PSTN and FTS interface (if attachment is permitted by TVE 0050P3B), interconnection and TCO terminating locations detailed on the contract drawings.
- b. The System shall provide the following minimum operational functions:
  - 1) Code Blue calls shall be cancelable at the calling station only. The nurse call master station (s) that a managing Code Blue functions shall not have the ability to cancel Code Blue calls.
  - 2) Each Code Blue system shall be able to receive audio calls from all bedside stations simultaneously.
  - 3) Calls placed from any Code Blue station shall generate Code Blue emergency type audible and visual signals at each associated nurse control and duty station, respective dome lights and all local and remote annunciator panels. Calls placed from a bedside station shall generate emergency type visual signals at the bedside station and associated dome light(s) in addition to the previous stated stations and panels.
  - 4) Activating the silencing device at any location, while a Code Blue call or system fault is occurring shall mute the audible signals at the alarm location.
    - a) The audible alarm shall regenerate at the end of the selected time-out period until the call or fault is corrected.
    - b) The visual signals shall continue until the call is canceled and/or a fault is corrected. When the fault is corrected, all signals generated by the fault shall automatically cease, returning the System to a standby status.
    - c) Audible signals shall be regenerated in any local or remote annunciator panel that is in the silence mode, in the event

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an additional Code Blue call is placed in any Code Blue system.

- d) The additional Code Blue call shall also generate visual signals at all annunciators to identify the location of the call.

2. Each System Nurse Call location shall generate a minimum of distinct calls:

- a. Routine: single flashing dome lights & master station color and audio tone,
- b. Staff Assist: rapid flashing dome lights & master station color and audio tone,
- c. Emergency: Red flashing dome lights & master station color and audio tone,
- d. Code Blue (if equipped): Blue flashing dome lights and master station color and audio tone,
- e. Each generated call shall be cancelable at ONLY the originating location,
- f. Staff Locator: Green Flashing dome lights & master station color and audio tone, and
- // g. \_\_\_\_\_: \_\_\_\_\_ Flashing dome lights & master station color and audio tone. //

**2.3 MANUFACTURERS**

- A. The products specified shall be new, FCC and UL Listed, labeled and produced by OEM manufacturer of record. An OEM of record shall be defined as a company whose main occupation is the manufacture for sale of the items of equipment supplied and which:
- 1. Maintains a stock of replacement parts for the item submitted,
  - 2. Maintains engineering drawings, specifications, and operating manuals for the items submitted, and
  - 3. Has published and distributed descriptive literature and equipment specifications on the items of equipment submitted at least 30 days prior to the Invitation for Bid.
- B. Specifications contained herein as set forth in this document detail the salient operating and performance characteristics of equipment in order for VA to distinguish acceptable items of equipment from unacceptable items of equipment. When an item of equipment is offered or furnished for which there is a specification contained herein, the

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item of equipment offered or furnished shall meet or exceed the specification for that item of equipment.

**C. Equipment Standards and Testing:**

1. The System has been defined herein as connected to systems identified as Critical Service performing various Emergency and Life Support Functions. Therefore, at a minimum, the system shall conform to all aforementioned National and/or Local Life Safety Codes (which ever are the more stringent), NFPA, NEC, this specification, JCAHCO Life Safety Accreditation requirements, and the OEM recommendations, instructions, and guidelines.
2. All supplies and materials shall be listed, labeled or certified by UL or a NRTL where such standards have been established for the supplies, materials or equipment.
3. The provided equipment required by the System design and approved technical submittal must conform with each UL standard in effect for the equipment, as of the date of the technical submittal (or the date when the RE approved system equipment necessary to be replaced) was technically reviewed and approved by VA. Where a UL standard is in existence for equipment to be used in completion of this contract, the equipment must bear the approved UL seal.
4. Each item of electronic equipment to be provided under this contract must bear the approved UL seal or the seal of the testing laboratory that warrants the equipment has been tested in accordance with, and conforms to the specified standards. The placement of the UL Seal shall be a permanent part of the electronic equipment that is not capable of being transportable from one equipment item to another.

**2.4 PRODUCTS**

**A. General.**

1. Contractor is responsible for pricing all accessories and miscellaneous equipment required to form a complete and operating system. The equipment quantities provided herein shall be as indicated on the drawings with the exception of the indicated spare equipment.
2. Contractor Furnished Equipment List (CFEs):
  - a. The Contractor is required to provide a list of the CFE equipment to be furnished. The quantity, make and model number of each item is required. Select the required equipment items quantities

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that will satisfy the needs of the system as described herein and with the OEM's concurrence applied to the list(s), in writing.

CONTRACTOR NOTE: Select the required equipment items quantities that will satisfy the needs of the system and edit between the // - - //. Do not delete equipment items that are not required - place a "0" in the appropriate Item location. The two color coded sections for the Mental Health and Blind Rehabilitation Units are provided for use when these units are a part of the project. If these units are not a part of the project - retain each unit's heading and place "0" in the respective "as required" column and delete the remaining system items.

<u>Item</u>		<u>Quantity</u>	<u>Unit</u>
1.	//As required//		Interface Panel(s)
1.a	//As required//		Electrical Supervision
			Trouble Enunciator
1.a.1	//As required//		Equipment Back Box(s)
1.b	//As required//		Telephone
1.c	//As required//		Public Address
1.d	//As required//		Radio Paging / Equipment
1.e	//As required//		Wireless / Equipment
1.f.	//As required//		Radio Pager / Equipment
1.g	//As required//		Wireless / Equipment
1.f	//As required//		Personal Communicator / Equipment
2.	//As required//		Lightning Arrestor
3.	//As required//		Head End Equipment/Locations
3.a	//As required//		Cabinet(s)
3.a.1	//As required//		AC Power Conditioner & Filter
3.a.2	//As required//		AC Power Strip
3.a.3	//As required//		UPS
3.a.4	//As required//		Interconnecting Wire/Cables
3.a.5	//As required//		Wire / Cable Connector(s)
3.a.6	//As required//		Wire / Cable Terminator(s)
3.b	//As required//		Wire Management System
3.b	//As required//		Head End Function(s)
3.b.1	//As required//		H7 Interface
3.b.2	//As required//		Nurse Locator
3.b.3	//As required//		Staff Locator
4.	//As required//		Master Station(s)
4.a	//As required//		Nurse Locator
4.b	//As required//		Staff Locator
5.	//As required//		Distribution System(s)
5.a	//As required//		Staff Station
5.a.1	//As required//		Equipment Back Box(s)
5.b	//As required//		Duty Station
5.b.1	//As required//		Equipment Back Box(s)
5.c	//As required//		Code Blue Station
5.c.1	//As required//		Equipment Back Box(s)

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5.c.2	2 (MIN)	Remote Station(s)
5.d	//As required//	Patient Station(s)
5.d.1	//As required//	Equipment Back Box(s)
5.d.2	//As required//	Bed Interface(s)
5.d.3	//As required//	Pillow Speaker
5.d.4	//As required//	Push Button Cordset
5.d.5	//As required//	Dummy Plugs
5.d.6	//As required//	Bed Integrated Control
5.d.7	//As required//	Lighting Interface Module
5.d.8	//As required//	TV Control Interface
5.d.9	//As required//	TV Control Jack
5.d.10	//As required//	TV Interconnection Cables
5.d.11	//As required//	HDTV Coaxial
5.d.12	//As required//	HDTV/Nurses Call Interface/ Control
5.d.13	//As required//	Auxiliary Mounting Interface
5.e	//As required//	Emergency Station(s)
5.e.1	//As required//	Equipment Back Box(s)
5.e.2	//As required//	Toilet Emergency Station (waterproof)
5.e.3	//As required//	Shower Emergency Station (waterproof)
5.e.4	//As required//	Lavatory Emergency Station (waterproof)
5.f.	//As required//	Room Dome Light
5.f.1	//As required//	Equipment Back Box(s)
5.g	//As required//	Other Dome Light(s)
5.g.1	//As required//	Equipment Back Box(s)
5.g.2	//As required//	Corridor Dome Light
5.g.3	//As required//	Intersectional Dome Light
5.h	//As required//	System Cable(s)
5.h.1	//As required//	Coaxial
5.h.2	//As required//	System Pin
5.h.3	//As required//	Audio
5.h.4	//As required//	Control
5.h.5	//As required//	Video
5.i	//As required//	System Connector(s)
5.i.1	//As required//	Coaxial
5.i.2	//As required//	System Pin
5.i.2	//As required//	Audio
5.i.3	//As required//	Control
5.i.4	//As required//	Video
5.j	//As required//	Wire Management Required as described herein
//6.	//As required//	<b>Mental Health Unit</b>
6.a	//As required//	<b>Head End Function(s)</b>
6.a.1	//As required//	<b>H7 Interface</b>
6.a.2	//As required//	<b>Nurse Locator</b>
6.a.3	//As required//	<b>Staff Locator</b>
6.b.	//As required//	<b>Master Station(s)</b>
6.b.1	//As required//	<b>Nurse Locator</b>
6.b.2	//As required//	<b>Staff Locator</b>
6.c	//As required//	<b>Distribution System(s)</b>
6.c.1	//As required//	<b>Staff Station</b>

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6.c.1.a	//As required//	Equipment Back Box(s)
6.c.2	//As required//	Duty Station
6.c.2.a	//As required//	Equipment Back Box(s)
6.c.3	//As required//	Patient Station(s)
6.c.3.a	//As required//	Equipment Back Box(s)\
6.c.4	//As required//	Security Room(s)
6.c.4.a	//As required//	Security Station(s)
6.c.4.b	//As required//	Equipment Back Box(s)\
6.c.4.c	//As required//	Overhead Speaker/Microphone
6.c.4.d	//As required//	Equipment Back Box(s)\
6.c.4.e	//As required//	TV Surveillance System
6.c.4.f	//As required//	Equipment Back Box(s)\
6.c.4.g	//As required//	TV Interconnection Cables
6.c.4.h	//As required//	Audio Interconnection Cables
6.c.5	//As required//	Emergency Station(s)
6.c.5.a	//As required//	Equipment Back Box(s)
6.c.5.b	//As required//	Toilet Emergency Station (waterproof)
6.c.5.c	//As required//	Shower Emergency Station (waterproof)
6.c.5.d	//As required//	Lavatory Emergency Station (waterproof)
6.c.6	//As required//	Room Dome Light
6.c.7	//As required//	Other Dome Light(s)
6.c.7.a	//As required//	Equipment Back Box(s)
6.c.7.b	//As required//	Corridor Dome Light
6.c.7.c	//As required//	Intersectional Dome Light
6.c.8	//As required//	System Cable(s)
6.c.8.a	//As required//	Coaxial
6.c.8.b	//As required//	System Pin
6.c.8.c	//As required//	Audio
6.c.8.d	//As required//	Control
6.c.8.e	//As required//	Video
6.c.9	//As required//	System Connector(s)
6.c.9.a	//As required//	Coaxial
6.c.9.b	//As required//	System Pin
6.c.9.c	//As required//	Audio
6.c.9.d	//As required//	Control
6.c.9.e	//As required//	Video
6.c.9.f	//As required//	Wire Management Required as described herein//
//7	//As required//	Blind Rehabilitation Unit
7.a	//As required//	Head End Function(s)
7.a.1	//As required//	H7 Interface
7.a.2	//As required//	Nurse Locator
7.a.3	//As required//	Staff Locator
7.b	//As required//	Master Station(s)
7.b.1	//As required//	Nurse Locator
7.b.2	//As required//	Staff Locator
7.c	//As required//	Distribution System(s)
7.c.1	//As required//	Staff Station
7.c.1.a	//As required//	Equipment Back Box(s)
7.c.2	//As required//	Duty Station
7.c.2.a	//As required//	Equipment Back Box(s)
7.c.3	//As required//	Patient Station(s)

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7.c.3.a	//As required//	Equipment Back Box(s)\
7.c.4	//As required//	Emergency Station(s)
7.c.4.a	//As required//	Equipment Back Box(s)
7.c.4.b	//As required//	Toilet Emergency Station (waterproof)
7.c.4.c	//As required//	Shower Emergency Station (waterproof)
7.c.4.d	//As required//	Lavatory Emergency Station (waterproof)
7.c.5	//As required//	Room Dome Light
7.c.5.a	//As required//	Equipment Back Box(s)
7.c.6	//As required//	Other Dome Light(s)
7.c.6.a	//As required//	Equipment Back Box(s)
7.c.6.b	//As required//	Corridor Dome Light
7.c.6.c	//As required//	Intersectional Dome Light
7.c.7	//As required//	System Cable(s)
7.c.7.a	//As required//	Coaxial
7.c.6.b	//As required//	System Pin
7.c.7.c	//As required//	Audio
7.c.7.d	//As required//	Control
7.c.7.e	//As required//	Video
7.c.8	//As required//	System Connector(s)
7.c.8.a	//As required//	Coaxial
7.c.8.b	//As required//	System Pin
7.c.8.c	//As required//	Audio
7.c.8.d	//As required//	Control
7.c.8.e	//As required//	Video
7.c.9	//As required//	Wire Management Required as described herein//
//8.	//As required//	Center for the Aging (aka Nursing Home Care Unit)
8.a	//As required//	Head End Function(s)
8.a.1	//As required//	H7 Interface
8.a.2	//As required//	Nurse Locator
8.a.3	//As required//	Staff Locator
8.b.	//As required//	Master Station(s)
8.b.1	//As required//	Nurse Locator
8.b.2	//As required//	Staff Locator
8.c	//As required//	Distribution System(s)
8.c.1	//As required//	Staff Station
8.c.1.a	//As required//	Equipment Back Box(s)
8.c.2	//As required//	Duty Station
8.c.2.a	//As required//	Equipment Back Box(s)
8.c.3	//As required//	Patient Station(s)
8.c.3.a	//As required//	Equipment Back Box(s)\
8.c.4	//As required//	Security Room(s)
8.c.4.a	//As required//	Security Station(s)
8.c.4.b	//As required//	Equipment Back Box(s)\
8.c.4.c	//As required//	Overhead Speaker/Microphone
8.c.4.d	//As required//	Equipment Back Box(s)\
8.c.4.e	//As required//	TV Surveillance System
8.c.4.f	//As required//	Equipment Back Box(s)\
8.c.4.g	//As required//	TV Interconnection Cables
8.c.4.h	//As required//	Audio Interconnection Cables
8.c.5	//As required//	Emergency Station(s)

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8.c.5.a	//As required//	Equipment Back Box(s)
8.c.5.b	//As required//	Toilet Emergency Station (waterproof)
8.c.5.c	//As required//	Shower Emergency Station (waterproof)
8.c.5.d	//As required//	Lavatory Emergency Station (waterproof)
8.c.6	//As required//	Room Dome Light
8.c.7	//As required//	Other Dome Light(s)
8.c.7.a	//As required//	Equipment Back Box(s)
8.c.7.b	//As required//	Corridor Dome Light
8.c.7.c	//As required//	Intersectional Dome Light
8.c.8	//As required//	System Cable(s)
8.c.8.a	//As required//	Coaxial
8.c.8.b	//As required//	System Pin
8.c.8.c	//As required//	Audio
8.c.8.d	//As required//	Control
8.c.8.e	//As required//	Video
8.c.9	//As required//	System Connector(s)
8.c.9.a	//As required//	Coaxial
8.c.9.b	//As required//	System Pin
8.c.9.c	//As required//	Audio
8.c.9.d	//As required//	Control
8.c.9.e	//As required//	Video
8.c.9.f	//As required//	Wire Management Required as described herein//
//9.	As required//	Oncology, Radiology, Dialysis, Units (These units are treated the same as Blind Rehabilitation Unit EXCEPT it does contains a CODE BLUE Function. If these units are provided as a part of the project, AT A MINIMUM - DUPLI-CATE THE BLINE REHABILITATION UNIT'S EQUIPMETN LISTE AND EDIT AND RENUMBER ACCORD-INGLY)//
10.		On Hand Spares Provide a separate system spares list as indicated in each equipment description.

B. NS Room(s):

Refer to CFM Physical Security Manual (07-2007) for VA Facilities,  
 Chapters 9.3 & 1) and PG 18-10, EDM, Chapters 7- Table 7-1, 8 &  
 Appendix B, Telecommunications One Line Topology for specific Room and  
 TIP Connection Requirements.

C. TER, SCC, PCR, STR, HER Rooms and Equipment:



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Refer to CFM Physical Security Manual (07-2007) for VA Facilities, Chapters 9.3 & 1) and PG 18-10, EDM, Chapters 7- Table 7-1, 8 & Appendix B, Telecommunications One Line Topology for specific Room and TIP Connection Requirements.

**D. Telecommunications Room(s) (TR):**

1. Locate the Nurse Call and/or Code Blue floor distribution equipment as required by system design and OEM direction. Provide secured and lockable cabinet/rack(s) as required.
2. Head-End Equipment:
  - a. Provide all required power supplies, communications hubs, network switches, intelligent controllers and other devices necessary to form a complete system. Head-end components may be rack mounted or wall mounted in an enclosed metal enclosure.
  - b. Provide the head end equipment in the closest Telecommunications Room where the System is installed.
  - c. Provide the System UPS inside the cabinet or in a separate cabinet adjacent to the head end cabinet that shall maintain a minimum of 30 minute battery back-up to all system components.
  - d. Equipment Cabinet: Comply with TIA/EIA-310-D. Lockable, ventilated metal cabinet houses terminal strips, power supplies, amplifiers, system volume control, and other switching and control devices required for conversation channels and control functions. See Paragraph 2.5.E for the Cabinet's minimum internal items that are in addition to the installed System equipment.
  - e. Vertical Equipment Rack, Wall Mounted (to be included inside of the Equipment Cabinet) containing the following minimum items:
    - 1) 36" (28RU) internal rack space, welded steel construction, minimum 20" usable depth, adjustable front mounting rails.
    - 2) Install the following products in rack provided by same manufacturer or as specified:
      - a) Security screws w/ nylon isolation bushings.
      - b) Textured blank panels.
      - c) Custom mounts for components without rack mount kits.
      - d) Security covers.
      - e) Internal system ground copper buss (may be substituted with a bare #0 AWG copper wire or equivalent size copper mesh

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strip connected to ONLY THE FACILITY'S SIGNAL GROUNDING SYSTEM.

- f) Power Sequencer- rack-mounted power conditioner and (provide as-needed) delayed sequencer(s) with (2) unswitched outlets each and contact closure control inputs. Connect the conditioner to one of the dual duplex outlets.
- g) Two (2) each 120VAC @ 20A dual duplex outlets, connected via conduit to the nearest Electrical Service Panel that is supplied by the Facility's Essential Electrical System.
- h) One (1) each 120VAC @ 15A Power Distribution Strip(s). Connect each strip to the unstitched outlet on the power conditioner.

**3. HL7 Interface:**

- a. The system may support downloading and updating of patient data from the hospital admission system (or other database) via the HL7 standard. The data only has to travel one way, i.e. from the admission system to the nurse-call system.
- b. Coordinate with the Owner the exact fields that will be populated from the admissions system in the nurse-call system.
- c. The Facility's LAN/WAN is not allowed for Nurses Call/Code Blue main wiring / function that must be a "stand alone primary cable infrastructure" as described herein.
- d. Connections to the VA LAN/WAN for functional or operable conditions will be allowed ONLY when the LAN/WAN system has been demonstrated and NFPA (at a minimum by TVE-0050P3B) Certified meeting Life Safety Standards.
- e. Provide one (1) spare HL Interface unit.

**//4. Wireless:**

- a. Radio Paging Equipment / Systems
  - 1) The nurse call/code blue system shall have the ability to interface ONLY with VA Certified and Licensed radio paging system (FCC Part 15 listed pagers and transmitters are not allowed for "Safety of Life" functions or installed in those specific areas - VA Headquarters TVE - 0050PB2 and SM - 0050PB2 are the ONLY approving authorities for this function) and must have the following minimum system features:

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- a) Ability to pass-through location information (such as a room number) and call-type as well as other text messages simultaneously to shift supervisor identified staff members
- b) System shall allow the operator to select staff members by name and pager number and to select a message consisting of a room number and a condition code (aka priority level). Operator may also choose to type in a unique alpha-numeric text message (the text message shall meet or exceed all HIPA and VA OCIS Communications Security Guidelines for the transmission of Patient or Staff Specific information [aka PII] - VA Headquarters TVE - 0050P2B is the approving authority for this function) into the system to be read by the holder of the pager unit.
- c) While a patient station is connected to the nurse's master station, the system shall allow the operator to automatically page the staff member assigned to that room. An alternate staff member may be selected for paging purposes in place of the primary staff member. The System must allow an alternate staff member to be paged when the primary staff member is unable to respond to patient's needs within a specified period of time. The System must have the ability to assign any bed to any pager or pager group, and to assign an unlimited amount of pagers to any patient bed.
- d) System shall have the ability to send all code blue calls to staff members by predetermined group (as required) automatically by simply pressing one "Code Blue" button. Pager shall indicate room number of code call, and state "Code Blue" in plain English format on pagers (*FCC Part 15 listed pagers are not allowed to be use as "Safety of Life" functions or those specific locations - VA Headquarters TVE - 0050P2B is the approving authority for this requirement*).

2) When pagers are approved, provide a minimum of ten (10) spare pagers with one spare pager for each 10 issued.//

//5. Personal Wireless Communicator

- a. The System will only be allowed to connect to the personal wireless communications system, pass text data and provide a 2-

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way communication between the Telephone Interface and the personal wireless communicator as long as it is not a FCC Part 15 listed device(s), meets or exceeds UL 60950-1/2, meets OCIS Guide Lines for FIPS 140-2 certification and the using staff shows an extensive training program along with recertification(s) according to the Facility Emergency Plan concerning HIPA requirements.

- b. VA Headquarters TVE - 0050P3B and SM - 0050P2B are the approving authority for this requirement.
  - c. When communicators are approved, provide a minimum of ten (10) spare communicators for each 10 communicators issued.//
- //6. Other Wireless Equipment / Systems
- a. Each proposed wireless system and/or equipment to be connected to or be a part of the System, each shall meet the minimum requirements outlines in Paragraph 2.7.A.
  - b. Contact TVE - 0050P3B and SM - 0050P2B for specific required PRE approvals (full or conditional) as described herein.
  - c. When approved, TVE-0050P3B and SM-0050P2B will provide the spare equipment requirements.
  - d. When other wireless components are approved, provide ten (10) components with one spare components for each 10 issued.//

F. TIP Cable Systems:

**Connect the system to the TIP system provided as a part of Speciation Section 27 15 00.** Provide additional TIP equipment, interfaces and connections as required by System design. Provide secured pathway(s) and lockable cabinet/rack(s) as required.

G. Interface Equipment:

1. TCR:

a. Code Blue Annunciation Station:

- 1) The Code Blue Remote Annunciation Station shall be located in the Telephone Operators Room, Police Control Center // or \_\_\_\_\_ //.
- 2) The Annunciation Station shall be connected to the System via hard wire connection(s) that shall contain all the electrical supervisory tone signals, visual bulbs, read out panel to indicate the location of the Code and system troubles.

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- 3) The System shall not be connected to the Telephone system unless specifically APPROVED BY VA HEADQUARTERS (0050P3B) and (0050P2B) PRIOR TO CONTRACT BID.
- 4) The Annunciation Station shall be installed in a location directly viewable and the readout is completely readable from the Public Address Microphone Control Console.
- 5) Provide one (1) spare panel.
- b. Electrical Supervision Trouble Annunciator Panel:
  - 1) The Electrical Supervision Trouble Annunciation Panel shall be located in the Telephone Operators Room, Police Control Center, associate Nurses Station(s) // and \_\_\_\_\_ //.
  - 2) The panel(s) shall be compatible with the generated electrical and/or electronic supervising signals to continuously monitor the operating condition for the System head-end processing equipment, master stations, staff stations, patient stations, duty stations, audio power amplifier(s), UPS, power supplies, dome lights and interconnecting trunks. The panels shall generate an audible and visual signal when the System's supervising system detects a system and equipment trouble or trunk-line is malfunctioning.
  - 3) Provide one (1) spare panel.
2. Hospital Bed Interface (s):
  - a. Provide a multi-pin receptacle for bed connection.
  - b. Connect cable from the multi-pin receptacle to the nurse-call system, so that alarms, such as bed exit, shall be monitored by the nurse-call system.
  - c. Connect cable from the multi-pin receptacle to the nurse-call system, so that the bedside control buttons, such as nurse call, and television controls are functional and monitored.
  - d. The hospital uses the following beds:
    - //1) Hill Rohm//
    - //2) Stryker//
    - //3) Other//
  - e. Provide one (1) spare interface for each ten (10) interfaces installed.
3. Nurse (aka Staff) Locator Interface:
  - a. The System must be capable of performing nurse-locator functions.

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- b. The System must be capable of performing staff-locator functions
- c. These functions may be combined into one operation.
- d. Provide two (2) spare interfaces.
- 4. Lighting Interface Module:
  - a. Provide an interface module for the pillow speakers to control up to 2 lights. Coordinate with the electrical contractor the exact voltage requirements.
  - b. Provide one (1) spare module for each ten (10) modules installed.
- 5. Pillow Speaker Interfaces:
  - a. See functional requirements herein.
  - b. Provide // (1) // // (2)// pillow speaker for each patient station.
  - c. Provide one (1) spare pillow speaker for each twenty (20) speakers installed.
- 6. TV Remote Control Interface:
  - a. The pillow speaker shall have the following TV control capability:
    - 1) Play the TV audio through the pillow speaker.
    - 2) Change channels up and down.
    - 3) Increase and decrease the volume.
    - 4) TV audio mute.
    - 5) UL Certified for direct patient contact.
  - b. Provide one (1) spare interface for each 20 interfaces installed.
- 7. TV Control Jack and Wiring:
  - a. Provide connection from the pillow speaker to the TV location. Terminate wire on a jack in the TV low voltage faceplate. Coordinate faceplate opening with the cabling contractor. Coordinate jack type with the TV (typically it is a ¼" jack, but verify prior to installation).
  - b. Provide patch cord from the TV control jack to the TV.
  - c. Provide one (1) spare complete assembly for each twenty (20) assemblies installed.
- //8. Additional Functions / Interfaces:

The nurse-call system may perform \_\_\_\_\_ additional services/ functions when specifically approved by TVE-0050P3B during the project design phases and prior to the bid process. //

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//9. TER

a. Paging adaptor (When connections are specifically approved by TVE 0050P3B):

- 1) The Contractor shall coordinate the installation of the paging adapter(s) designed for use with the Facility's telephone system with the Facility Telephone Contractor or local telephone company.
- 2) The Contractor shall provide and install a paging adapter(s) for each zone and sub zone. The paging adapter(s) shall be accessible by dialing a telephone number provided by the Facility's Telephone Contractor. The Paging Adapter shall:
  - a) Monitor each audio input and output on the unit.
  - b) Be provided with an electrical supervision panel to provide both audio and visual trouble alarms.
  - c) Be provided as part of the headend equipment and shall be located in the Telephone Switch Room.
  - d) Be provide with Executive Paging Override of all routine paging calls in progress or being accessed to allow system "all call" (aka global) and radio paging calls designated as Code One Blue) functions.
  - e) Be capable of internal time out capability.
  - f) Function completely with the interface module.
  - g) Provide one spare adapter.

3) Time Out Device:

A time out device/capability shall be provided to prevent system "hang-up" due to an off-hook telephone. The device shall be able to be preset from 30 seconds to two (2) minutes. Its function shall not interfere with or override the required "all call" (aka global) operational capability.//

H. Call Initiation, Annunciation and Response:

1. Light and Tones:

a Calls may be initiated through:

- 1) Patient station.
- 2) Staff station.
- 3) Code Blue station.
- 4) Toilet Emergency Station pull cord / push button.
- 5) Shower Emergency Station pull cord.

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- 6) Bed Pillow speaker.
  - 7) Bed Push-button cordset.
  - 8) Hospital Bed Integrated controls.
  - b Once a call is initiated, it must be annunciated at the following locations:
    - 1) The Corridor, Intersectional and Room dome light associated with the initiating device.
    - 2) A local master control station indicating the call location and priority.
    - 3) Each duty station.
    - 4) Each staff station.
    - 5) Each remote location.
  - c) All calls must be displayed until they are cleared by the nursing staff **ONLY** from the initiating device location.
2. Voice:
- a Calls may be initiated through:
    - 1) Patient station.
    - 2) Staff station.
    - 3) Code Blue station.
    - 4) Toilet Emergency pull cord / push button station.
    - 5) Shower Emergency pull cord station.
    - 6) Pillow speaker.
    - 7) Push-button cordset.
    - 8) Integrated bed controls.
    - 9) Master Station.
- //10. Mental Health (aka Psychiatric) Unit. //
- //11. Blind Rehabilitation Unit. //
- b. Once a call is initiated, it must be annunciated at the following locations:
    - 1) The Corridor, Intersectional and Room dome light associated with the initiating device.
    - 2) A master station indicating the call location and priority.
    - 3) Any duty stations associated with the unit.
    - 4) Any staff Stations associated with the unit.
    - 5) Each remote location.
  - c. All calls must be displayed until they are cleared by the nursing staff **ONLY** from the initiating device location.



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3. Provide two-way voice communication between a master station and patient, staff, duty and each of the two (2) remote stations.
4. Failure of voice intercom portion of system shall not interfere with visual and audible signal systems.
5. All calls must be displayed on the master station until they are cleared by the nursing staff at ONLY the originating station. If multiple calls are received at the master station within a short period of time, they shall be stacked based on priority and wait time. If there are more calls than the master station screen can display at one time (four [4] minimum), the system must provide a simple scrolling feature. The nurse must be able to answer any call in any order at the master station. The nurse must also be able to forward calls to staff members. If a call is not answered within a programmable time period, then the system must forward the call to appropriate back-up staff identified by each shift supervisor in a manner technically approved by VA Headquarters 0050P3B.

//6. Radio pager (**within the restrictions identified herein**) //

//7. Wireless personal communicator (**within the restrictions identified herein**) //

**I. Auxiliary Alarm Monitoring:**

1. Each patient station must have the ability to connect a separate and isolated auxiliary alarm to it such as an infusion pump or data tracking / recording device (patient life support units ARE NOT allowed to be connected to these units **UNLESS APPROVED BY TVE - 0050P3B DURING THE PROJECT DEVELOPMENT PHASE AS DESCRIBED HEREIN.**

The System must support naming the device that is being monitored as well as display its alarms at the master station and via the room / corridor dome light(s).

2. Provide // **(2)** // alarm jacks at each patient station.
3. The above requirements may ONLY be allowed when the system has been approved by VA Headquarters TVE - 0050P3B and TVE - 0050P2B and concurred by the appropriate Medical Service(s) indicates it meets the minimum guidelines and requirements of Paragraph 2.8.A.

**J. Patient and Staff Assignment:**

1. System may provide for transfer of one or more individual or groups of stations from one master station to another without mechanical switches or additional wiring of the stations. The transfer may be

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initiated manually be the nurse or automatically at certain times of the day.

2. The Facility's LAN/WAN IS NOT ALLOWED for Nurses Call/Code Blue main wiring which must be a "stand alone primary cable infrastructure."

**Connections to the VA LAN/WAN will be allowed ONLY when the LAN/WAN system has been demonstrated and certified by TVE - 0050P3B meeting the minimum guidelines and requirements of the Life Safety Code.**

**K. Reports:**

1. The system's generated reports logging all calls, alarms, response time, bed, and staff assignments may be allowed to transmit these reports to a central archiving entity.
2. Reports function shall be limited by passwords and security tier level access, so that only supervisors may access it when desired.
3. Provide instructions to the owner on how to enable/disable the reporting functions.
4. The Facility's LAN/WAN IS NOT ALLOWED for Nurses Call/Code Blue main wiring that must be a "stand alone primary cable infrastructure." Connections to the VA LAN/WAN will be allowed ONLY when the system has been demonstrated and certified by 0050P2B meeting the minimum guidelines and requirements of the Life Safety Code.

**L. System/Management Software:**

1. Provide and install system/management software on minimum of three (3) owner-provided computers.
  - a. The management software shall at a minimum provide all historical reporting features of the system as well as real-time monitoring of events.
  - b. The system software shall at a minimum provide the system's operating and functioning parameters and script. The OEM shall provide VA with access to the software's script writing and functions.
2. Provide two (2) spare CD's with the software installed and operable.
3. Rights in Data: VA shall have the right to all script and programming language of system management software. If commercial off the shelf (COTS) or a memorandum of understanding (MOU) is required for follow-on maintenance, the Contractor is required to accomplish the COTS Survey document and the RE is required to

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accomplish the COTS Acquisition document supplied in Part 5 Attachments herein.

M. System Functional Station:

1. Master Control:

a. Simple Tone and Light:

- 1) A visual / aural (tone only) system shall be provided, protected and located in the Day Hospital, Mental Health & Blind Rehabilitation Areas, OPC where surgery or procedures are not performed and // \_\_\_\_ //. The System shall include a push-button emergency station (pull cord in Day Hospital and pushbutton in Mental Health & Blind Rehabilitation areas) with an associated corridor dome light in each dressing room (OPC) and toilet (OPC, Day Hospital, Mental Health, Blind Rehabilitation and // \_\_\_\_ //) and // \_\_\_\_ in the \_\_\_\_ //.
- 2) The visual / aural (tone only) system shall also include a power supply and a visual / aural (tone only) display panel in the respective OPC receptionist / secretary's office and the Day Hospital // \_\_\_\_ // area and as shown on the drawings. The visual / tone display panel shall generate audible and visual emergency signals to indicate the location of a placed call.
- 3) The Visual Display Panel shall be a digital readout touch screen to visually announce the location of incoming calls placed in the System including room and bed number and priority of the call. Identify each calling station with an individual display, including separate displays for each patient sharing a dual bedside station. If a digital readout touch screen standard is not required or approved by the Facility during the project design phase, an alpha - numeric scheme shall be provided that identifies the: ward, room and bed (i.e. Ward 2a, Room 201, Bed A (or 1) shall read 2A201A - or- 2A201-1. Equivalent readouts are acceptable as long as TVE 0050P3B and the Facility approve the readout).
  - a) Calls placed at emergency stations located in toilets and baths inside bedrooms shall be displayed for the bed

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closest to the nurse control station. Beds in multi-bed bedrooms shall be identified in a clock-wise pattern upon entering the bedroom.

- b) It shall display a minimum of four incoming calls. Additional placed calls shall be stored in order of placement and priority.

- 4) The visual / aural (tone only) system shall be installed according to the same Procedures, guidelines and standards outlined for a regular Nurse Call System for emergency ***NOT CODE BLUE OPERATION.***

- 5) Speakerphone and handset communication.

- 6) Provide one (1) spare station for each ten (1) stations installed.

b. Touch Screen:

- 1) Provide a touch screen master station with 15" minimum monitor size.
- 2) The master station shall have a full control capability over staff assignment to patients and beds as well as pagers and wireless personal communication devices (when specifically approved by 0050P3B on a case by case basis).
- 3) Speakerphone and handset communication.
- 4) Provide one (1) spare station for each ten (1) stations installed.

2. Staff:

- a. Light and Tine Only.
- b. Voice Communications Enabled.
- c. Provide one (1) spare station for each twenty (20) stations installed.

3. Duty:

- a. Light and Tine Only.
- b. Voice Communications Enabled.
- c. Provide one (1) spare station for each twenty (20) stations installed.

4. Patient:

- a. Single & Dual:
  - 1) Provide each patient station with the following minimum Feature.

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- a) Call button.
- b) Call answered button.
- c) Pillow speaker jack.
- d) Auxiliary alarm monitoring jack.
- e) Hospital bed interface jack (when specially approved by TVE - 0050P3B).
- f) Provide one (1) spare station for each twenty (20) stations installed.

N. Distribution System: Refer to Specification Sections 27 11 00, Structured TIP Communications Cables; 27 11 00, TIP Communications Interface and Equipment Rooms Fittings and 27 15 00, HORIZONTAL and Vertical TIP Communications Cabling for additional specific TIP wire and cable standards and installation requirements used to install the Facility's TIP network.

1. In addition to the TIP provided under the aforementioned Specification Sections, the contractor shall provide the following additional TIP installation and testing requirements, provide the following minimum additional System TIP requirements, cables & interconnections:
  - a. Each wire and cable used in the System shall be specifically OEM certified by tags on each reel and recommended and approved for installation in the Facility.
  - b. The Contractor shall provide the RE a 610 mm (2 foot) sample of each wire and/or cable actually employed in the System and each certification tag for approval before continuing with the installation as described herein.
  - c. Fiberoptic Cables: Refer to Specification Section 27 15 00, Horizontal and Vertical TIP Communications Cabling; Paragraph 2.4.C12.d. Fiberoptic Cables - for minimum technical standards and requirements for additional System cables.
  - d. Copper Cables: Refer to Specification Section 27 15 00, Horizontal and Vertical TIP Communications Cabling; Paragraph 2.4.C12.c. Copper Cables - for minimum technical standards and requirements for additional System voice and data cables.
  - e. Line Level Audio and Microphone Cable:
    - 1) Line level audio and microphone cable for inside racks and conduit.

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- 2) Shielded, twisted pair Minimum 22AWG, stranded conductors and 24AWG drain wire with overall jacket.
- f. Speaker Level Audio (70.7Volt RMS):
  - 1) For use with 70.7V speaker circuits.
  - 2) 18AWG stranded pair, minimum.
- g. All cabling shall be //plenum// or //riser (UL-1666)// rated.
- h. Provide one (1) spare 1,000 foot roll of approved System (not microphone) cable only.
- 2. Raceways, Back Boxes and conduit:
  - a. In addition to the Raceways, Equipment Room Fittings provided under Specification Sections 27 15 00 TIP Communication Room Fittings and 27 15 00 - TIP Communications Horizontal and Vertical Cabling, provide the following additional TIP raceway and fittings:
  - b. Each raceway that is open top, shall be: UL certified for telecommunications systems, partitioned with metal partitions in order to comply with NEC Parts 517 & 800 to "mechanically separate telecommunications systems of different service, protect the installed cables from falling out when vertically mounted and allow junction boxes to be attached to the side to interface "drop" type conduit cable feeds.
  - c. Intercommunication System cable infrastructure: EMT or in J-hooks above accessible ceilings, 24 inches on center.
  - d. Junction boxes shall be not less than 2-1/2 inches deep and 6 inches wide by 6 inches long.
  - e. Flexible metal conduit is prohibited unless specifically approved by 0050P3B.
  - f. System Conduit:
    - 1) The PA system is NFPA listed as Emergency / Public Safety Communication System which requires the entire system to be installed in a separate conduit system.
    - 2) The use of centralized mechanically partitioned wireways may be used to augment main distribution conduit on a case by case basis when specifically approved by VA Headquarters (0050P3B).
  - 3) Conduit Sleeves:
    - a) The AE has made a good effort to identify where conduit sleeves through full-height and fire rated walls on the

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drawings, and has instructed the electrician to provide the sleeves as shown on the drawings.

- b) While the sleeves shown on the drawings will be provided by others, the contractor is responsible for installing conduit sleeves and fire-proofing where necessary. It is often the case, that due to field conditions, the nurse-call cable may have to be installed through an alternate route. Any conduit sleeves required due to field conditions or those omitted by the engineer shall be provided by the cabling contractor.

g. Device Back Boxes:

- 1) Furnish to the electrical contractor all back boxes required for the PA system devices.
- 2) The electrical contractor shall install the back boxes as well as the system conduit. Coordinate the delivery of the back boxes with the construction schedule.

3. UPS:

- a. Provide a backup battery or a UPS for the System to allow normal operation and function (as if there was no AC power failure) in the event of an AC power failure or during input power fluctuations for a minimum of 30 minutes.
- b. As an alternate solution, the telephone system UPS may be utilized to meet this requirement at the headend location, as long as this function is specifically approved by the Telephone Contractor and the RE.
- c. The Nurse Call Contractor shall not make any attachments or connection to the telephone system until specifically directed to do so, in writing, by the RE.
- d. Provide UPS for all active system components including but not limited to:
  - 1) System Amplifiers.
  - 2) Microphone Consoles.
  - 3) Telephone Interface Units.
  - 4) TER, TR & Headend Equipment Rack(s).

O. Patient Bedside Prefabricated Units (PBPU):

- 1. Where PBPU's exist in the Facility; the Contractor shall identify the "gang box" location on the PBPU designated for installation of

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the telephone jack. This location shall here-in-after be identified as the unit's TCO. The Contractor shall be responsible for obtaining written approval and specific instructions from the PBPU OEM regarding the necessary disassembly and reassembly of each PBPU to the extent necessary to pull wire from above the TIP ceiling junction box to the PBPU's reserved gang box for the unit's TCO. A Contractor provided stainless steel cover plate approved for use by the PBPU OEM and Facility IRM Chief shall finish out the jack installation.

2. Under no circumstances shall the Contractor proceed with the PBPU installations without the written approval of the PBPU OEM and the specific instructions regarding the attachment to or modifying of the PBPU. The RE shall be available to assist the Contractor in obtaining approvals and instructions in a timely manner as related to the project's time constraints.
3. It is the responsibility of the Contractor to maintain the UL integrity of each PBPU. If the Contractor violates that integrity, it shall be the responsibility of the Contractor to obtain on site UL re-certification of the violated PBPU at the direction of the RE and at the Contractor's expense.

**P. Installation Kit:**

1. General: The kit shall be provided that, at a minimum, includes all connectors and terminals, labeling systems, audio spade lugs, barrier strips, punch blocks or wire wrap terminals, heat shrink tubing, cable ties, solder, hangers, clamps, bolts, conduit, cable duct, and/or cable tray, etc., required to accomplish a neat and secure installation. All wires shall terminate in a spade lug and barrier strip, wire wrap terminal or punch block. Unfinished or unlabeled wire connections shall not be allowed. Turn over to the RE all unused and partially opened installation kit boxes, coaxial, fiberoptic, and twisted pair cable reels, conduit, cable tray, and/or cable duct bundles, wire rolls, physical installation hardware. The following are the minimum required installation sub-kits:
  2. System Grounding:



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- a. The grounding kit shall include all cable and installation hardware required. All radio equipment shall be connected to earth ground via internal building wiring, according to the NEC.
- b. This includes, but is not limited to:
  - 1) Fiberoptic Optic Cable Armor/External Braid
  - 2) Coaxial Cable Shields.
  - 3) Control Cable Shields.
  - 4) Data Cable Shields.
  - 5) Equipment Racks.
  - 6) Equipment Cabinets.
  - 7) Conduits.
  - 8) Cable Duct.
  - 9) Cable Trays.
  - 10) Interduct
  - 11) Power Panels.
  - 12) Connector Panels.
  - 15) Grounding Blocks.
3. Fiberoptic Cable: The fiberoptic cable kit shall include all fiberoptic connectors, cable tying straps, interduct, heat shrink tubing, hangers, clamps, etc. required to accomplish a neat and secure installation.
4. Coaxial Cable: The coaxial cable kit shall include all coaxial connectors, cable tying straps, heat shrink tubing, hangers, clamps, etc., required to accomplish a neat and secure installation.
5. Wire and Cable: The wire and cable kit shall include all connectors and terminals, audio spade lugs, barrier straps, punch blocks, wire wrap strips, heat shrink tubing, tie wraps, solder, hangers, clamps, labels etc., required to accomplish a neat and orderly installation.
6. Conduit, Cable Duct, and Cable Tray: The kit shall include all conduit, duct, trays, junction boxes, back boxes, cover plates, feed through nipples, hangers, clamps, other hardware required to accomplish a neat and secure conduit, cable duct, and/or cable tray installation in accordance with the NEC and this document.
7. Equipment Interface: The equipment kit shall include any item or quantity of equipment, cable, mounting hardware and materials needed to interface the systems with the identified sub-system(s) according to the OEM requirements and this document.

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8. Labels: The labeling kit shall include any item or quantity of labels, tools, stencils, and materials needed to completely and correctly label each subsystem according to the OEM requirements, as-installed drawings, and this document.
  9. Documentation: The documentation kit shall include any item or quantity of items, computer discs, as installed drawings, equipment, maintenance, and operation manuals, and OEM materials needed to completely and correctly provide the system documentation as required by this document and explained herein.
- // Q. MENTAL HEALTH (aka PSYCHIATRIC) UNIT - when a Mental Health Unit is to be provided as a part of the project, provide each unit as follows:
1. EMERGENCY STATION:
    - a. A push-button emergency station shall be provided in each toilet stall and each shower/bath facility in Mental Health Units. Shower emergency stations shall be installed inside the shower stall at the shower head end. They shall be installed approximately a minimum of 18 inches from the showerhead itself and at a maximum of 72 inches above the finished floor. Each station inside shower and toilet areas shall be equipped with a rubber gasket between the faceplate and wall or be rated by UL as waterproof. The gasket shall cover and water seal the entire back box opening and not extend beyond the sides of the associated faceplate by  $\frac{1}{4}$ " MAX. If the wall is tile or other uneven type material the gasket and associated faceplate shall be provided to completely seal the opening and uneven material surface.
    - b. Fasten each emergency station faceplate to the back-boxes with tamperproof screws.
  2. SECURITY ROOMS:
    - a. Provide Security rooms in a Mental Health Unit with an emergency wall station containing a key activated switch. Provide four (4) emergency pushbutton stations and a four-inch flush mounted ceiling microphone/speaker.
    - b. Mount all equipment with tamperproof screws.
    - c. Activating the switch shall energize each emergency station in the security room.
    - d. Selection of the security room station at the nurse control station shall permit two-way voice communication within the room

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and nurse control station, through the ceiling  
microphone/speaker.

- e. Pressing the push-button on any security room emergency station shall generate emergency visual signals in the corridor dome light and emergency audible and visual signals at the nurse control station.

- f. Provide six (6) keys for each Mental Health Unit.

3. PATIENT STATION:

- a. Provide a patient station with pushbutton, microphone/speaker.
- b. Mount all equipment with tamperproof screws.
- c. Selection of the patient room station at the nurse control station shall permit two-way voice communication within the room and nurse control station, through the ceiling microphone/speaker.
- d. Pressing the push-button on any patient room station shall generate visual signals in the corridor dome light and routine audible and visual signals at the nurse control station.
- e. The patient wall station shall be equipment with a method (aka separate push-button) to initiate an emergency call in the room and corridor dome lights and nurse call station.

4. NURSE CONTROL (aka MASTER) STATION - provide a station as described herein. //

// R. BLIND REHABILITATION UNIT- when a Blind Rehabilitation Unit is to be provided as a part of the project, provide each unit as follows with TVE 0050P3B reviewed and approved units designed specifically for service and functions in this type of unit (aka brail, audible and like recognition):

1. EMERGENCY STATION:

- a. A push-button emergency station shall be provided in each toilet stall and each shower/bath facility in Psychiatric Units. Shower emergency stations shall be installed inside the shower stall at the shower head end. They shall be installed approximately a minimum of 18 inches from the showerhead itself and at a maximum of 72 inches above the finished floor. Each station inside shower and toilet areas shall be equipped with a rubber gasket between the faceplate and wall or be rated by UL as waterproof. The gasket shall cover and water seal the entire back box opening

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and not extend beyond the sides of the associated faceplate by ¼" MAX. If the wall is tile or other uneven type material the gasket and associated faceplate shall be provided to completely seal the opening and uneven material surface.

- b. Fasten each emergency station faceplate to the back-boxes with tamperproof screws.
  - c. Pressing the push-button on any emergency station shall generate visual signals in the room & corridor dome light(s) and emergency audible and visual signals at the nurse control station.
2. PATIENT STATION:
- a. Provide a patient station with pushbutton, microphone/speaker.
  - b. Mount all equipment with tamperproof screws.
  - c. Selection of the patient room station at the nurse control station shall permit two-way voice communication within the room and nurse control station, through the patient wall microphone/speaker.
  - d. Pressing the push-button on any patient wall station shall generate visual signals in the Room & corridor dome light(s) and routine audible and visual signals at the nurse control station.
  - e. The patient wall station shall be equipment with a method (aka separate push-button) to initiate an emergency call in the room and corridor dome lights and nurse call station.
3. NURSE CONTROL (aka MASTER) STATION - provide a station as described herein. //

// P. ONCOLOGY, RADIOLOGY, DIALYSIS UNITS - when a these Units are to be provided as a part of the project, provide each unit as follows with TVE 0050P3B reviewed and approved units designed specifically for service and functions in this type of unit (aka brail, audible and like recognition:

1. CODE BLUE - provide a Code Blue System as described herein.

**2. EMERGENCY STATION:**

- a. A push-button emergency station shall be provided in each toilet stall and each shower/bath facility in Psychiatric Units. Shower emergency stations shall be installed inside the shower stall at the shower head end. They shall be installed approximately a minimum of 18 inches from the showerhead itself and at a maximum of 72 inches above the finished floor. Each station inside

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shower and toilet areas shall be equipped with a rubber gasket between the faceplate and wall or be rated by UL as waterproof. The gasket shall cover and water seal the entire back box opening and not extend beyond the sides of the associated faceplate by ¼" MAX. If the wall is tile or other uneven type material the gasket and associated faceplate shall be provided to completely seal the opening and uneven material surface.

- b. Fasten each emergency station faceplate to the back-boxes with tamperproof screws.
  - c. Pressing the push-button on any emergency station shall generate visual signals in the room & corridor dome light(s) and emergency audible and visual signals at the nurse control station.
3. PATIENT STATION:
- a. Provide a patient station with pushbutton, microphone/speaker.
  - b. Mount all equipment with tamperproof screws.
  - c. Selection of the patient room station at the nurse control station shall permit two-way voice communication within the room and nurse control station, through the patient wall microphone/speaker.
  - d. Pressing the push-button on any patient wall station shall generate visual signals in the Room & corridor dome light(s) and routine audible and visual signals at the nurse control station.
  - e. The patient wall station shall be equipment with a method (aka separate push-button) to initiate an emergency call in the room and corridor dome lights and nurse call station.
4. NURSE CONTROL (aka MASTER) STATION - provide a station as described herein. //

**PART 3 - EXECUTION**

**3.1 PROJECT MANAGEMENT**

- A. Assign a single project manager to this project who will serve as the point of contact for the Owner, the General Contractor, and the Engineer.
- B. The Contractor shall be proactive in scheduling work at the hospital, specifically the Contractor will initiate and maintain discussion with the general contractor regarding the schedule for ceiling cover up and install cables to meet that schedule.

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- C. Contact the Office of Telecommunications, Special Communications Team (0050P2B) at (301) 734-0350 to have a VA Certified Telecommunications COTR assigned to the project for telecommunications review, equipment and system approval and co-ordination with VA's Spectrum Management and OCIS Teams.

**3.2 COORDINATION WITH OTHER TRADES**

- A. Coordinate with the cabling contractor the location of the TV faceplate and the faceplate opening for the nurse call TV control jack.
- B. Coordinate with the cabling contractor the location of TIP equipment in the TER, TCR, PCR, SCC, ECR, STRs, NSS, and TCOs in order to connect to the TIP cable network that was installed as a part of Section Specification 27 11 00. Contact the RE immediately, in writing, if additional location(s) are discovered to be activated that was not previously provided.
- C. Before beginning work, verify the location, quantity, size and access for the following:
  - 1. Isolated ground AC power circuits provided for systems.
  - 2. Primary, emergency and extra auxiliary AC power generator requirements.
  - 3. Junction boxes, wall boxes, wire troughs, conduit stubs and other related infrastructure for the systems.
  - 4. System components installed by others.
  - 5. Overhead supports and rigging hardware installed by others.
- D. Immediately notify the Owner, GC and Consultant(s) in writing of any discrepancies.

**3.3 NEEDS ASSESSMENT**

Provide a one-on-one meeting with the particular nursing manager of each unit affected by the installation of the new nurse call/code blue system. Review the floor plan drawing, educate the nursing manager with the functions of the equipment that is being provided and gather details specific to the individual units; coverage and priorities of calls; staffing patterns; and other pertinent details that will affect system programming and training.

**3.4 INSTALLATION**

- A. General:
  - 1. Execute work in accordance with National, State and local codes, regulations and ordinances.

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2. Install work neatly, plumb and square and in a manner consistent with standard industry practice. Carefully protect work from dust, paint and moisture as dictated by site conditions. The Contractor will be fully responsible for protection of his work during the construction phase up until final acceptance by the Owner.
3. Install equipment according to OEM's recommendations. Provide any hardware, adaptors, brackets, rack mount kits or other accessories recommended by OEM for correct assembly and installation.
4. Secure equipment firmly in place, including receptacles, speakers, equipment racks, system cables, etc.
  - a. All supports, mounts, fasteners, attachments and attachment points shall support their loads with a safety factor of at least 5:1.
  - b. Do not impose the weight of equipment or fixtures on supports provided for other trades or systems.
  - c. Any suspended equipment or associated hardware must be certified by the OEM for overhead suspension.
  - d. The Contractor is responsible for means and methods in the design, fabrication, installation and certification of any supports, mounts, fasteners and attachments.
5. Finishes for any exposed work such as plates, racks, panels, speakers, etc. shall be approved by the Architect, Owner and TVE 0050P3B.
6. Coordinate cover plates with field conditions. Size and install cover plates as necessary to hide joints between back boxes and surrounding wall. Where cover plates are not fitted with connectors, provide grommets in size and quantity required. Do not allow cable to leave or enter boxes without cover plates installed.
7. Active electronic component equipment shall consist of solid state components, be rated for continuous duty service, comply with the requirements of FCC standards for telephone and data equipment, systems, and service.
8. Color code all distribution wiring to conform to the Nurse Call Industry Standard, EIA/TIA, and this document, whichever is the more stringent. At a minimum, all equipment, cable duct and/or conduit, enclosures, wiring, terminals, and cables shall be clearly and

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- permanently labeled according to and using the provided record drawings, to facilitate installation and maintenance.
9. Connect the System's primary input AC power to the Facility's Critical Branch of the Emergency AC power distribution system as shown on the plans or if not shown on the plans consult with RE regarding a suitable circuit location prior to bidding.
  10. Product Delivery, Storage and Handling:
    - a. Delivery: Deliver materials to the job site in OEM's original unopened containers, clearly labeled with the OEM's name and equipment catalog numbers, model and serial identification numbers. The RE may inventory the cable, patch panels, and related equipment.
    - b. Storage and Handling: Store and protect equipment in a manner, which will preclude damage as directed by the RE.
  11. Where TCOs are installed adjacent to each other, install one outlet for each instrument.
  12. Equipment installed outdoors shall be weatherproof or installed in weatherproof enclosures with hinged doors and locks with two keys.
- B. Equipment Racks/Cabinets:
1. Fill unused equipment mounting spaces with blank panels or vent panels. Match color to equipment racks/cabinets.
  2. Provide security covers for all devices not requiring routine operator control.
  3. Provide vent panels and cooling fans as required for the operation of equipment within the OEM' specified temperature limits. Provide adequate ventilation space between equipment for cooling. Follow manufacturer's recommendations regarding ventilation space between amplifiers.
  4. Provide insulated connections of the electrical raceway to equipment racks.
  5. Provide continuous raceway/conduit with no more than 40% fill between wire troughs and equipment racks/cabinets for all non-plenum-rated cable. Ensure each system is mechanically separated from each other in the wireway.



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6. Ensure a minimum of 36 inches around each cabinet and/or rack to comply with OSHA Safety Standards. Cabinets and/or Racks installed side by side - the 36" rule applies to around the entire assembly

C. Distribution Frames.

1. A new stand-alone (i.e., self supporting, free standing) PA rack/frame may be provided in each TR to interconnect the TCR, PCR, SCC, NS, STRs & ECRs. Rack/frames shall be wired in accordance with industry standards and shall employ "latest state-of-the-art" modular cross-connect devices. The PA riser cable shall be sized to satisfy all voice/digital requirements plus not less than 50% spare (growth) capacity in each TR which includes a fiber optic backbone.
2. The frames/racks shall be connected to the TER/MCR system ground.

D. Wiring Practice - in addition to the MANDATORY infrastructure requirements outlined in VA Construction Specifications 27 10 00 - TIP Structured Communications Cabling, 27 11 00 - TIP Communications Rooms Fittings and 27 15 00 - TIP Horizontal and Vertical Communicators Cabling, the following additional practices shall be adhered too:

1. Comply with requirements for raceways and boxes specified in Division 26 Section "Raceway and Boxes for Electrical Systems."
2. Execute all wiring in strict adherence to the National Electrical Code, applicable local building codes and standard industry practices.
3. Wiring shall be classified according to the following low voltage signal types:
  - a. Balanced microphone level audio (below -20dBm) or Balanced line level audio (-20dBm to +30dBm)
  - b. 70V audio speaker level audio.
  - c. Low voltage DC control or power (less than 48VDC)
4. Where raceway is to be EMT (conduit), wiring of differing classifications shall be run in separate conduit. Where raceway is to be an enclosure (rack, tray, wire trough, utility box) wiring of differing classifications which share the same enclosure shall be mechanically partitioned and separated by at least four (4) inches. Where Wiring of differing classifications must cross, they shall cross perpendicular to one another.

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5. Do not splice wiring anywhere along the entire length of the run. Make sure cables are fully insulated and shielded from each other and from the raceway for the entire length of the run.
6. Do not pull wire through any enclosure where a change of raceway alignment or direction occurs. Do not bend wires to less than radius recommended by manufacturer.
7. Replace the entire length of the run of any wire or cable that is damaged or abraided during installation. There are no acceptable methods of repairing damaged or abraided wiring.
8. Use wire pulling lubricants and pulling tensions as recommended by the OEM.
9. Use grommets around cut-outs and knock-outs where conduit or chase nipples are not installed.
10. Do not use tape-based or glue-based cable anchors.
11. Ground shields and drain wires to the Facility's signal ground system as indicated by the drawings.
12. Field wiring entering equipment racks shall be terminated as follows:
  - a. Provide OEM directed service loops at harness break-outs and at plates, panels and equipment. Loops should be sufficient to allow plates, panels and equipment to be removed for service and inspection.
  - b. Line level and speaker level wiring may be terminated inside the equipment rack using specified terminal blocks (see "Products.") Provide 15% spare terminals inside each rack. Microphone level wiring may only be terminated at the equipment served.
  - c. If specified terminal blocks are not designed for rack mounting, utilize  $\frac{3}{4}$ " plywood or  $\frac{1}{8}$ " thick aluminum plates/blank panels as a mounting surface. Do not mount on the bottom of the rack.
  - d. Employ permanent strain relief for any cable with an outside diameter of 1" or greater.
13. Use only balanced audio circuits unless noted otherwise directed and indicated on the drawings.
14. Make all connections as follows:
  - a. Make all connections using rosin-core solder or mechanical connectors appropriate to the application.

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- b. For crimp-type connections, use only tools that are specified by the manufacturer for the application.
  - c. Use only insulated spade lugs on screw terminals. Spade lugs shall be sized to fit the wire gauge. Do not exceed two lugs per terminal.
  - d. Wire nuts, electrical tape or "Scotch Lock" connections are not acceptable for any application.
15. Noise filters and surge protectors shall be provided for each equipment interface cabinet, switch equipment cabinet, control console, local, and remote active equipment locations to ensure protection from input primary AC power surges and noise glitches are not induced into low Voltage data circuits.
16. Wires or cables **previously approved** to be installed outside of conduit, cable trays, wireways, cable duct, etc:
- a Only when specifically authorized as described herein, will wires or cables be identified and approved to be installed outside of conduit. The wire or cable runs shall be UL rated plenum and OEM certified for use in air plenums.
  - b Wires and cables shall be hidden, protected, fastened and tied at 600 mm (24 in.) intervals, maximum, as described herein to building structure.
  - c Closer wire or cable fastening intervals may be required to prevents sagging, maintain clearance above suspended ceilings, remove unsightly wiring and cabling from view and discourage tampering and vandalism. Wire or cable runs, not provided in conduit, that penetrate outside building walls, supporting walls, and two hour fire barriers shall be sleeved and sealed with an approved fire retardant sealant.
  - d Wire or cable runs to system components installed in walls (i.e.: volume attenuators, circuit controllers, signal, or data outlets, etc.) may, when specifically authorized by the RE, be fished through hollow spaces in walls and shall be certified for use in air plenum areas.
  - e Completely test all of the cables after installation and replace any defective cables.
  - f Wires or cables that are installed outside of buildings shall be in conduit, secured to solid building structures. If specifically

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approved, on a case by case basis, to be run outside of conduit, the wires or cables shall be installed, as described herein. The bundled wires or cables must: Be tied at not less than 460 mm (18 in.) intervals to a solid building structure; have ultra violet protection and be totally waterproof (including all connections). The laying of wires or cables directly on roof tops, ladders, drooping down walls, walkways, floors, etc. is not allowed and will not be approved.

- E. Cable Installation - Cable Installation - In addition to the **MANDATORY** infrastructure requirements outlined in VA Construction Specifications 27 10 00 - Structured TIP Communications Cabling, 27 11 00 - TIP Communications Rooms and Fittings and 27 15 00 - TIP Communications Horizontal and Vertical Cabling and the following additional practices shall be adhered too:
1. Support cable on maximum 2'-0" centers. Acceptable means of cable support are cable tray, j-hooks, and bridal rings. Velcro wrap cable bundles loosely to the means of support with plenum rated Velcro straps. Plastic tie wraps are not acceptable as a means to bundle cables.
  2. Run cables parallel to walls.
  3. Install maximum of 10 cables in a single row of J-hooks. Provide necessary rows of J-hooks as required by the number of cables.
  4. Do not lay cables on top of light fixtures, ceiling tiles, mechanical equipment, or ductwork. Maintain at least 2'-0" clearance from all shielded electrical apparatus.
  5. All cables shall be tested after the total installation is fully complete. All test results are to be documented. All cables shall pass acceptable test requirements and levels. Contractor shall remedy any cabling problems or defects in order to pass or comply with testing. This includes the re-pull of new cable as required at no additional cost to the Owner.
  6. Ends of cables shall be properly terminated on both ends per industry and OEM's recommendations.
  7. Provide proper temporary protection of cable after pulling is complete before final dressing and terminations are complete. Do not leave cable lying on floor. Bundle and tie wrap up off of the floor until you are ready to terminate.

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8. Terminate all conductors; no cable shall contain unterminated elements. Make terminations only at outlets and terminals.
  9. Splices, Taps, and Terminations: Arrange on numbered terminal strips in junction, pull, and outlet boxes; terminal cabinets; and equipment enclosures. Cables may not be spliced.
  10. Bundle, lace, and train conductors to terminal points without exceeding OEM's limitations on bending radii. Install lacing bars and distribution spools.
  11. Cold-Weather Installation: Bring cable to room temperature before dereeling. Heat lamps shall not be used.
  12. Cable shall not be run through structural members or be in contact with pipes, ducts, or other potentially damaging items.
  13. Separation of Wires: (REFER TO RACEWAY INSTALLATION) Separate speaker-microphone, line-level, speaker-level, and power wiring runs. Install in separate raceways or, where exposed or in same enclosure, separate conductors at least 12 inches apart for speaker microphones and adjacent parallel power and telephone wiring. Separate other intercommunication equipment conductors as recommended by equipment manufacturer.
  14. Serve all cables as follows:
    - a. Cover the end of the overall jacket with a 1" (minimum) length of transparent heat-shrink tubing. Cut unused insulated conductors 2" (minimum) past the heat-shrink, fold back over jacket and secure with cable-tie. Cut unused shield/drain wires 2" (minimum) past the Heatshrink and serve as indicated below.
    - b. Cover shield/drain wires with heat-shrink tubing extending back to the overall jacket. Extend tubing ¼" past the end of unused wires, fold back over jacket and secure with cable tie.
    - c. For each solder-type connection, cover the bare wire and solder connection with heat-shrink tubing.
- F. Labeling: Provide labeling in accordance with ANSI/EIA/TIA-606-A. All lettering for Nurse Call and/or Code Blue circuits shall be stenciled using **// laser printers // // thermal ink transfer process // //-----**  
**-//.**
1. Cable and Wires (Hereinafter referred to as "Cable"): Cables shall be labeled at both ends in accordance with ANSI/EIA/TIA-606-A.

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Labels shall be permanent in contrasting colors. Cables shall be identified according to the System "Record Wiring Diagrams."

2. Equipment: System equipment shall be permanently labeled with contrasting plastic laminate or Bakelite material. System equipment shall be labeled on the face of the unit corresponding to its source.
  - a. Clearly, consistently, logically and permanently mark switches, connectors, jacks, relays, receptacles and electronic and other equipment.
  - b. Engrave and paint fill all receptacle panels using 1/8" (minimum) high lettering and contrasting paint.
  - c. For rack-mounted equipment, use engraved Lamacoid labels with white 1/8" (minimum) high lettering on black background. Label the front and back of all rack-mounted equipment.
3. Conduit, Cable Duct, and/or Cable Tray: The Contractor shall label all conduit, duct and tray, including utilized GFE, with permanent marking devices or spray painted stenciling a minimum of 3 meters (10 ft.) identifying it as the System. In addition, each enclosure shall be labeled according to this standard.
4. Termination Hardware: The Contractor shall label TCOs and patch panel connections using color coded labels with identifiers in accordance with ANSI/EIA/TIA-606-A and the "Record Wiring Diagrams."
5. Where multiple pieces of equipment reside in the same rack group, clearly and logically label each indicating to which room, channel, receptacle location, etc. they correspond.
6. Permanently label cables at each end, including intra-rack connections. Labels shall be covered by the same, transparent heat-shrink tubing covering the end of the overall jacket. Alternatively, computer generated labels of the type which include a clear protective wrap may be used.
7. Contractor's name shall appear no more than once on each continuous set of racks. The Contractor's name shall not appear on wall plates or portable equipment.
8. Ensure each OEM supplied item of equipment has appropriate UL Labels / Marks for the service the equipment is performed permanently attached / marked to a non-removal board in the unit. **EQUIPMENT INSTALLED NOT BEARING THESE UL MARKS WILL NOT BE ALLOWED TO BE A**

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PART OF THE SYSTEM. THE CONTRACTOR SHALL BEAR ALL COSTS REQUIRED TO PROVIDE REPLACEMENT EQUIPMENT WITH APPROVED UL MARKS.

G. Conduit and Signal Ducts: When the Contractor and/or OEM determines additional system conduits and/or signal ducts are required in order to meet the system minimum performance standards outlined herein, the contractor shall provide these items as follows:

1. Conduit:

- a. The Contractor shall employ the latest installation practices and materials. The Contractor shall provide conduit, junction boxes, connectors, sleeves, weather heads, pitch pockets, and associated sealing materials not specifically identified in this document as GFE. Conduit penetrations of walls, ceilings, floors, interstitial space, fire barriers, etc., shall be sleeved and sealed.
- b. All cables shall be installed in separate conduit and/or signal ducts (exception from the separate conduit requirement to allow Nurse Call and/or Code Blue cables to be installed in partitioned cable tray with voice cables may be granted in writing by the RE if requested). Conduits shall be provided in accordance with Section 27 05 33, RACEWAYS AND BOXES FOR COMMUNICATIONS SYSTEMS, and NEC Articles 517 for Critical Care and 800 for Communications systems, at a minimum.
- c. When metal, plastic covered, etc., flexible cable protective armor or systems are specifically authorized to be provided for use in the System, their installation guidelines and standards shall be as specified herein, Section 27 05 33, RACEWAYS AND BOXES FOR COMMUNICATIONS SYSTEMS, and the NEC.
- d. When "interduct" flexible cable protective systems is specifically authorized to be provided for use in the System, it's installation guidelines and standards shall be as the specified herein, Section 27 05 33, RACEWAYS AND BOXES FOR COMMUNICATIONS SYSTEMS, and the NEC.
- e. Conduit fill (including GFE approved to be used in the system) shall not exceed 40%. Each conduit end shall be equipped with a protective insulator or sleeve to cover the conduit end, connection nut or clamp, to protect the wire or cable during installation and remaining in the conduit. Electrical power

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conduit shall be installed in accordance with the NEC. AC power conduit shall be run separate from signal conduit.

- f. Ensure that Critical Care Nurse Call and/or Code Blue //, and \_\_\_\_\_ // Systems (as identified by NEC Section 517) are completely separated and protected from all other systems.

**2. Signal Duct, Cable Duct, or Cable Tray:**

- a. The Contractor shall use GFE signal duct, cable duct, and/or cable tray, when identified and approved by the RE.
- b. Approved signal and/or cable duct shall be a minimum size of 100 mm x 100 mm (4 in. X 4 in.) inside diameter with removable tops or sides, as appropriate. Protective sleeves, guides or barriers are required on all sharp corners, openings, anchors, bolts or screw ends, junction, interface and connection points.
- c. Approved cable tray shall be fully covered, mechanically and physically partitioned for multiple electronic circuit use, and be UL certified and labeled for use with telecommunication circuits and/or systems. The RE shall approve width and height dimensions.
- d. All cable junctions and taps shall be accessible. Provide an 8" X 8" X 4" (minimum) junction box attached to the cable duct or raceway for installation of distribution system passive equipment. Ensure all equipment and tap junctions are accessible

**3.5 PROTECTION OF NETWORK DEVICES**

- A. Contractor shall protect network devices during unpacking and installation by wearing manufacturer approved electrostatic discharge (ESD) wrist straps tied to chassis ground. The wrist strap shall meet OSHA requirements for prevention of electrical shock, should technician come in contact with high voltage.

**3.6 CUTTING, CLEANING AND PATCHING**

- A. It shall be the responsibility of the contractor to keep their work area clear of debris and clean area daily at completion of work.
- B. It shall be the responsibility of the contractor to patch and paint any wall or surface that has been disturbed by the execution of this work.
- C. The Contractor shall be responsible for providing any additional cutting, drilling, fitting or patching required that is not indicated as provided by others to complete the Work or to make its parts fit together properly.



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- D. The Contractor shall not damage or endanger a portion of the Work or fully or partially completed construction of the Owner or separate contractors by cutting, patching or otherwise altering such construction, or by excavation. The Contractor shall not cut or otherwise alter such construction by the Owner or a separate contractor except with written consent of the Owner and of such separate contractor; such consent shall not be unreasonably withheld. The Contractor shall not unreasonably withhold from the Owner or a separate Contractor the Contractor's consent to cutting or otherwise altering the Work.
- E. Where coring of existing (previously installed) concrete is specified or required, including coring indicated under unit prices, the location of such coring shall be clearly identified in the field and the location shall be approved by the Project Manager prior to commencement of coring work.

**3.7 FIREPROOFING**

- A. Where Nurse Call and/or Code Blue wires, cables and conduit penetrate fire rated walls, floors and ceilings, fireproof the opening.
- B. Provide conduit sleeves (if not already provided by electrical contractor) for cables that penetrate fire rated walls and Telecommunications Rooms floors and ceilings. After the cabling installation is complete, install fire proofing material in and around all conduit sleeves and openings. Install fire proofing material thoroughly and neatly. Seal all floor and ceiling penetrations.
- C. Use only materials and methods that preserve the integrity of the fire stopping system and its rating.
- D. Install fireproofing where low voltage cables are installed in the same manholes with high voltage cables; also cover the low voltage cables with arc proof and fireproof tape.
- E. Use approved fireproofing tape of the same type as used for the high voltage cables, and apply the tape in a single layer, one-half lapped or as recommended by the manufacturer. Install the tape with the coated side towards the cable and extend it not less than 25 mm (one inch) into each duct.
- F. Secure the tape in place by a random wrap of glass cloth tape.

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**3.8 GROUNDING**

- A. Ground Nurse Call and/or Code Blue cable shields and equipment to eliminate shock hazard and to minimize ground loops, commonmode returns, noise pickup, cross talk, and other impairments as specified in CFM Division 27, Section 27 05 26 - Grounding and Bonding for Communications Systems.
- B. Facility Signal Ground Terminal: Locate at main room or area signal ground within the room (i.e. head end and telecommunications rooms) or area(s) and indicate each signal ground location on the drawings.
- C. Extend the signal ground to inside each equipment cabinet and/or rack. Ensure each cabinet and/or rack installed item of equipment is connected to the extended signal ground. Isolate the signal ground from power and major equipment grounding systems.
- D. When required, install grounding electrodes as specified in CFM Division 26, Section 26 05 26 -Grounding and Bonding for Electrical Systems.
- E. Do not use "3<sup>rd</sup> or 4<sup>th</sup>" wire internal electrical system conductors for communications signal ground.
- F. Do not connect the signal ground to the building's external lightning protection system.
- G. Do Not "mix grounds" of different systems.
- H. Insure grounds of different systems are installed as to not violate OSHA Safety and NEC installation requirements for protection of personnel.

**PART 4 - TESTING / GUARANTY / TRAINING**

**4.0 SYSTEM LISTING**

The Nurses Call System is NFPA listed as an "Emergency" Communication system. Where Code Blue signals are transmitted, that listing is elevated to "Life Support/Safety." Therefore, the following testing and guaranty provisions are the minimum to be performed and provided by the contractor and Warranted by the OEM.

**4.1 PROOF OF PERFORMANCE TESTING**

- A. Intermediate Testing:
  - 1. After completion of 30 - 40% of the installation of a head end cabinet(s) **//and interconnection to the corresponding System Patient Head Wall Units //** and equipment, one master stations, local and remote stations, treatment rooms, and prior to any further work,

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this portion of the system must be pretested, inspected, and 1certified. Each item of installed equipment shall be checked to ensure appropriate UL Listing and Certification Labels are affixed as required by NFPA -Life Safety Code 101-3.2 (a) & (b), UL Nurse Call Standard 1069 and JCHCO evaluation guidelines, and proper installation practices are followed. The intermediate test shall include a full operational test.

2. All inspections and tests shall be conducted by an OEM-certified contractor representative and witnessed by TVE-0050P3B if there is no local Government Representative that processes OEM and VA approved Credentials to inspect and certify the system. The results of the inspection will be officially recorded by the Government Representative and maintained on file by the RE, until completion of the entire project. The results will be compared to the Acceptance Test results. An identical inspection may be conducted between the 65 - 75% of the system construction phase, at the direction of the RE.

**B. Pretesting:**

1. Upon completing installation of the Nurse Call and/or Code Blue System, the Contractor shall align, balance, and completely pretest the entire system under full operating conditions.
2. Pretesting Procedure:
  - a. During the System Pretest the Contractor shall verify (utilizing approved test equipment) that the System is fully operational and meets all the System performance requirements of this standard.
  - b. The Contractor shall pretest and verify that all PSM System functions and specification requirements are met and operational, no unwanted aural effects, such as signal distortion, noise pulses, glitches, audio hum, poling noise, etc. are present. At a minimum, each of the following locations shall be fully pretested:
    - 1) Central Control Cabinets.
    - 2) Nurse Control Stations.
      - a) Master Stations
      - b) Patient Stations
      - c) Staff Stations
      - d) Emergency Stations

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- e) Code Blue Stations
  - 3) Dome Lights.
    - a) Patient Rooms
    - b) Corridors
    - c) Intersectional
  - 4) STRs
  - 5) Local and Remote Enunciation Panels (code blue).
  - 6) Electrical Supervision Panels/Functions/locations.
  - 7) All Networked locations.
  - 8) System interface locations (i.e. wireless, PA, telephone, etc.).
  - 9) System trouble reporting.
  - 10) System electrical supervision.
  - 11) UPS operation.
  - 12) Primary / Emergency AC Power Requirements
  - 13) Extra Auxiliary Generator Requirements.
  - 14) NSs.
3. The Contractor shall provide four (4) copies of the recorded system pretest measurements and the written certification that the System is ready for the formal acceptance test shall be submitted to the RE.

**C. Acceptance Test:**

1. After the Nurse Call and/or Code Blue System has been pretested and the Contractor has submitted the pretest results and certification to the RE, then the Contractor shall schedule an acceptance test date and give the RE 15 working days written notice prior to the date the acceptance test is expected to begin. The System shall be tested in the presence of a TVE 0050P3B and OEM certified representatives. The System shall be tested utilizing the approved test equipment to certify proof of performance and Life Safety / Critical Service compliance. The tests shall verify that the total System meets all the requirements of this specification. The notification of the acceptance test shall include the expected length (in time) of the test.
2. The acceptance test shall be performed on a "go-no-go" basis. Only those operator adjustments required to show proof of performance shall be allowed. The test shall demonstrate and verify that the

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installed System does comply with all requirements of this specification under operating conditions. The System shall be rated as either acceptable or unacceptable at the conclusion of the test. Failure of any part of the System that precludes completion of system testing, and which cannot be repaired in four (4) hours, shall be cause for terminating the acceptance test of the System. Repeated failures that result in a cumulative time of eight (8) hours to affect repairs shall cause the entire System to be declared unacceptable.

3. Retesting of the entire System shall be rescheduled at the convenience of the Government and costs borne by the Contractor at the direction of the SRE.

**D. Acceptance Test Procedure:**

**1. Physical and Mechanical Inspection:**

- a. The TVE 0050P3B Representative will tour all major areas where the Nurse Call and/or Code Blue System and all sub-systems are completely and properly installed to insure they are operationally ready for proof of performance testing. A system inventory including available spare parts will be taken at this time. Each item of installed equipment shall be checked to ensure appropriate UL certification labels are affixed.
- b. The System diagrams, record drawings, equipment manuals, TIP Auto CAD Disks, intermediate, and pretest results shall be formally inventoried and reviewed.
- c. Failure of the System to meet the installation requirements of this specification shall be grounds for terminating all testing.

**2. Operational Test:**

- a. After the Physical and Mechanical Inspection, the central terminating and nurse call master control equipment shall be checked to verify that it meets all performance requirements outlined herein. A spectrum analyzer and sound level meter may be utilized to accomplish this requirement.
- b. Following the central equipment test, a pillow speaker (or on board speaker) shall be connected to the central terminating and nurse call master control equipment's output tap to ensure there are no signal distortions such as intermodulation, data noise, popping sounds, erratic system functions, on any function.

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- c. The distribution system shall be checked at each interface, junction, and distribution point, first, middle, and last intersectional, room, and bed dome light in each leg to verify that the nurse call distribution system meets all system performance standards.
  - d. Each MATV outlet that is controlled by a nurse call pillow speaker shall be functionally tested at the same time utilizing the Contractor's approved hospital grade HDTV receiver and TV remote control cable.
  - e. The RED system and volume stepper switches shall be checked to insure proper operation of the pillow speaker, the volume stepper and the RED system (if installed).
  - f. Additionally, each installed emergency, patient, staff, duty, panic station, intersectional, room, and bed dome light, power supply, code one, and remote annunciator panels shall be checked insuring they meet the requirements of this specification.
  - g. Once these tests have been completed, each installed sub-system function shall be tested as a unified, functioning and fully operating system. The typical functions are: nurse follower, three levels of emergency signaling (i.e. flashing red emergency, flashing white patient emergency, flashing white or combination lights for staff emergency, separate flashing code blue), minimum of 10 minutes of UPS operation, memory saving, minimum of ten station audio paging, canceling emergency calls at each originating station only, and storage and prioritizing of calls.
  - h. Individual Item Test: The TVE 0050P3B Representative will select individual items of equipment for detailed proof of performance testing until 100% of the System has been tested and found to meet the contents of this specification. Each item shall meet or exceed the minimum requirements of this document.
3. Test Conclusion:
- a. At the conclusion of the Acceptance Test, using the generated punch list (or discrepancy list) the VA and the Contractor shall jointly agree to the results of the test, and reschedule testing on deficiencies and shortages with the RE. Any retesting to comply with these specifications will be done at the Contractor's expense.

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- b. If the System is declared unacceptable without conditions, all rescheduled testing expenses will be borne by the Contractor.
- E. Acceptable Test Equipment: The test equipment shall be furnished by the Contractor shall have a calibration tag of an acceptable calibration service dated not more than 12 months prior to the test. As part of the submittal, a test equipment list shall be furnished that includes the make and model number of the following type of equipment as a minimum:
1. Spectrum Analyzer.
  2. Signal Level Meter.
  3. Volt-Ohm Meter.
  4. Sound Pressure Level (SPL) Meter.
  5. Oscilloscope.
  6. Pillow Speaker Test Set (Pillow Speaker with appropriate load and cross connections in lieu of the set is acceptable).
  7. Patient Push Button Cord Test Set.
  8. Patient Bed with connecting multiple conductor cord.

**4.2 WARRANTY**

- A. Comply with FAR 52.246-21, except that warranty shall be as follows:
- B. Contractor's Responsibility:
1. The Contractor shall warrant that all provided material and equipment will be free from defects, workmanship and will remain so for a period of one year from date of final acceptance of the System by the VA. The Contractor shall provide OEM's equipment warranty documents, to the RE (or Facility Contracting Officer if the Facility has taken possession of the building), that certifies each item of equipment installed conforms to OEM published specifications.
  2. The Contractor's maintenance personnel shall have the ability to contact the Contractor and OEM for emergency maintenance and logistic assistance, remote diagnostic testing, and assistance in resolving technical problems at any time. This contact capability shall be provided by the Contractor and OEM at no additional cost to the VA.
  3. All Contractor maintenance and supervisor personnel shall be fully qualified by the OEM and must provide two (2) copies of current and qualified OEM training certificates and OEM certification upon request.

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4. Additionally, the Contractor shall accomplish the following minimum requirements during the two year guaranty period:
  - a. Response Time during the Two Year Guaranty Period:
    - 1) The RE (or Facility Contracting Officer if the system has been turned over to the Facility) is the Contractor's ONLY OFFICIAL reporting and contact official for nurse call system trouble calls, during the guaranty period.
    - 2) A standard work week is considered 8:00 A.M. to 5:00 P.M. or as designated by the RE (or Facility Contracting Officer), Monday through Friday exclusive of Federal Holidays.
  - 3) The Contractor shall respond and correct on-site trouble calls, during the standard work week to:
    - a) A routine trouble call within one (1) working day of its report. A routine trouble is considered a trouble which causes a pillow speaker or cordset, one (1) master nurse control station, patient station, emergency station, or dome light to be inoperable.
    - b) Routine trouble calls in critical emergency health care facilities (i.e., cardiac arrest, intensive care units, etc.) shall also be deemed as an emergency trouble call. The RE (or Facility Contracting Officer) shall notify the Contractor of this type of trouble call.
    - c) An emergency trouble call within four hours of its report. An emergency trouble is considered a trouble which causes a sub-system (ward), distribution point, terminal cabinet, or code one system to be inoperable at anytime.
  - 4) If a Nurse Call and/or Code Blue/ component failure cannot be corrected within four (4) hours (exclusive of the standard work time limits), the Contractor shall be responsible for providing alternate nurse call equipment. The alternate equipment/system shall be operational within a maximum of 20 hours after the four (4) hour trouble shooting time and restore the effected location operation to meet the System performance standards. If any sub-system or major system trouble cannot be corrected within one working day, the Contractor shall furnish and install compatible substitute equipment returning the System or sub-system to full



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operational capability, as described herein, until repairs are complete.

b. Required On-Site Visits during the Two Year Guaranty Period

- 1) The Contractor shall visit, on-site, for a minimum of eight (8) hours, once every 12 weeks, during the guaranty period, to perform system preventive maintenance, equipment cleaning, and operational adjustments to maintain the System according the descriptions identified in this document.
- 2) The Contractor shall arrange all Facility visits with the RE (or Facility Contracting Officer) prior to performing the required maintenance visits.
- 3) Preventive maintenance shall be performed by the Contractor in accordance with the OEM's recommended practice and service intervals during non-busy time agreed to by the RE (or Facility Contracting Officer) and Contractor.
- 4) The preventive maintenance schedule, functions and reports shall be provided to and approved by the RE (or Facility Contracting Officer).
- 5) The Contractor shall provide the RE (or Facility Contracting Officer) a type written report itemizing each deficiency found and the corrective action performed during each required visit or official reported trouble call. The Contractor shall provide the RE with sample copies of these reports for review and approval at the beginning of the Acceptance Test. The following reports are the minimum required:
  - a) The Contractor shall provide a monthly summary all equipment and sub-systems serviced during this warranty period to RE (or Facility Contracting Officer) by the fifth (5<sup>th</sup>) working day after the end of each month. The report shall clearly and concisely describe the services rendered, parts replaced and repairs performed. The report shall prescribe anticipated future needs of the equipment and systems for preventive and predictive maintenance.
  - b) The Contractor shall maintain a separate log entry for each item of equipment and each sub-system of the System. The log shall list dates and times of all scheduled, routine, and emergency calls. Each emergency call shall be

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described with details of the nature and causes of emergency steps taken to rectify the situation and specific recommendations to avoid such conditions in the future.

6) The RE (or Facility Contracting Officer) shall convey to the Facility Engineering Officer, two (2) copies of actual reports for evaluation.

a) The RE (or Facility Contracting Officer) shall ensure a copy of these reports is entered into the System's official acquisition documents.

b) The Facility Chief Engineer shall ensure a copy of these reports is entered into the System's official technical record documents.

C. Work Not Included: Maintenance and repair service shall not include the performance of any work due to improper use; accidents; other vendor, contractor, or owner tampering or negligence, for which the Contractor is not directly responsible and does not control. The Contractor shall immediately notify the RE or Facility Contracting Officer in writing upon the discovery of these incidents. The RE or Facility Contracting Officer will investigate all reported incidents and render

#### **4.3 TRAINING**

A. Provide thorough training of all nursing staff assigned to those nursing units receiving new networked nurse/patient communications equipment. This training shall be developed and implemented to address two different types of staff. Floor nurses/staff shall receive training from their perspective, and likewise, unit secretaries (or any person whose specific responsibilities include answering patient calls and dispatching staff) shall receive operational training from their perspective. A separate training room will be set up that allows this type of individualized training utilizing in-service training unit, prior to cut over of the new system.

B. Provide the following minimum training times and durations:

1. **//48//** hours prior to opening for nursing staff (in 8-hour increments) - split evenly over 3 weeks and day and night shifts. Coordinate schedule with Owner.
2. **//32//** hours during the opening week for nursing staff - both day and night shifts.
3. **//24//** hours for supervisors and system administrators.

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5.0 ATTACHMENTS

- A. The following items are required as a part of the system:
  - 1. COTS Documents:
    - a.

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**CHECKLIST FOR SOFTWARE LICENSING AGREEMENTS**  
(For use in commercial item acquisition [COTS] conforming to – FAR Part 12)

<b>The Government may not be able to accept standard commercial licensing agreement without modification; <u>you must</u> negotiate terms and conditions so it is consistent with the FAR and the VAAR.</b>		
<b>Is the license (check all that apply):</b>	<b>Yes</b>	<b>No</b>
Exclusive		
Non-exclusive		
Perpetual		
Limited term		
If limited term, state the period (months or years):		
If limited term, is there an automatic renewal provision?		
CPU based		
If CPU based, state number of machines and whether simultaneous use is permitted:		
Site license		
If site license, state the site/location:		
Network license		
Other basis (e.g., # of users, # of transactions, etc.) (state specifics)		
Applicable to only the current version (doesn't apply to future versions)		
Software maintenance included at no extra cost		
Allow for office relocation or transfer		
Allow copying for backup or archival purpose		
Allow no cost copy at disaster recovery site		
Restricted on Use: (see note below)		
Restricted on the processing of data by or for user's subsidiaries and affiliates		
Restricted on processing of third party data (or use in service bureau)		
Restricted on network use		
Restricted on site and equipment limitations		
Restricted on number of users (e.g., cannot exceed _____ # of users)		

<b>Terms and Conditions that may need to be negotiated:</b>	<b>Yes</b>	<b>No</b>
Does the license prohibit use of the software outside of the Government? If yes, this needs to be deleted/modified if other Government contractors need access to the software (as GFP) to fulfill obligations of their own contracts.		
Does license state that the software is Year 2000 compliant or include a Year 2000 warranty? If no, must ensure it is compliant per FAR 39 or include a Y2K warranty.		
Does the license state that it provides no warranties or guarantees of any kind? If yes, need to determine whether additional warranty would be in the best interest of the Government.		
Does the license warrant that the software does not contain any code (e.g., virus) that will disable the software, and if such code exists, that Licensor agrees to indemnify the licensee (user) for all damages suffered as a result of such code? If no, need to negotiate for such warranty.		
Does the license allow access to source code? If no, negotiate for access if software will be modified or customized for the Government's needs or if the Government intends to maintain the software itself.		
Does the license require Licensor to deposit source code in escrow account? If no and source code is needed, consider negotiating for this provision, and state what "release conditions" are.		
Does the license allow the Government to hold the rights to customized code and to the data that the software manipulates? If no, negotiate for the rights if the Government (customer) requires them.		
Does the license authorize us to copy user manuals for internal purposes? If no, negotiate for authorization if multiple copies must be made for our internal use or ensure that the vendor supplies adequate number of copies. May also negotiate for updated manuals at periodic intervals, e.g., with each major update.		
Does the license state that licensee modifications to the software void all warranties? If yes, ensure that the vendor still warrants the unmodified portions.		
Does the license include clauses that prohibit needed uses of software, restrict the use of output from the software, or inappropriately burden the operation of the computer facilities? If yes, need to negotiate better terms and conditions.		
Is the dispute clause in the license consistent with FAR 52.233-1, Disputes Clause? If no, then need to modify license to be consistent with FAR.		
Does the default clause in the license allow for the Government to terminate for convenience or for cause, consistent with FAR 52.212-4(l) or FAR 52.212-4(m)? If no, then need to modify license to be consistent with FAR Part 12 (not FAR Part 49).		

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b.

SOLICITATION/CONTRACT/ORDER FOR COMMERCIAL ITEMS				1. REQUISITION NUMBER		PAGE 1 OF	
OFFEROR TO COMPLETE BLOCKS 12, 17, 23, 24, & 30						7	
2. CONTRACT NO.		3. AWARD/EFFECTIVE DATE SEE BLOCK 31C		4. ORDER NUMBER		5. SOLICITATION NO.	
						6. SOLICITATION ISSUE DATE	
7. FOR SOLICITATION INFORMATION		a. NAME			b. TELEPHONE NUMBER (No collect calls)		8. OFFER DUE DATE/ LOCAL TIME
9. ISSUED BY:		CODE		10. THIS ACQUISITION IS <input type="radio"/> UNRESTRICTED <input type="checkbox"/> SETASIDE: 100 % FOR <input type="checkbox"/> SMALL BUSINESS <input type="radio"/> HUBZONE SMALL BUSINESS <input type="radio"/> 8(A) NAICS: 541511 SIZE STANDARD:		11. DELIVERY FOR FOB DESTINATION UNLESS BLOCK IS MARKED <input type="radio"/> SEE SCHEDULE <input type="radio"/> 13a. THIS CONTRACT IS A RATED ORDER UNDER DPAS (15 CFR 700) 13b. RATING	
						14. METHOD OF SOLICITATION <input checked="" type="checkbox"/> RFQ <input type="checkbox"/> IFB <input type="checkbox"/> RFP	
15. DELIVER TO			CODE		16. ADMINISTERED BY		
					CODE		
				See #9 above			
17a. CONTRACTOR/			FACILITY		18a. PAYMENT WILL BE		
CODE			TY		MADE BY		
OFFEROR			CODE		UNITED STATES OF AMERICA Department of Veterans Affairs FMS P.O. Box 149971 Austin, TX 78714-8971		
TELEPHONE NO: 703.246-0392							
<input type="radio"/> 17b. CHECK IF REMITTANCE IS DIFFERENT AND PUT SUCH ADDRESS IN OFFER				18b. SUBMIT INVOICES TO ADDRESS SHOWN IN BLOCK 18a. UNLESS BLOCK BELOW IS CHECKED <input checked="" type="checkbox"/> SEE ADDENDUM			

19. ITEM NO.	20. SCHEDULE OF SUPPLIES/SERVICES	21. QUANTITY	22. UNIT	23. UNIT PRICE	24. AMOUNT
	See page 2				
	Use Reverse and/or (Attach Additional Sheets as Necessary)				
25. ACCOUNTING AND APPROPRIATION DATA				26. TOTAL AWARD AMOUNT (For Govt. Use Only)	

52.227-14, 52.227-16, and 52.227-19. ADDENDA

O 29. AWARD OF CONTRACT: REF.  
\_\_\_\_\_ OFFER  
\_\_\_\_\_  
DATED \_\_\_\_\_. YOUR OFFER ON  
SOLICITATION (BLOCK 5),  
INCLUDING ANY ADDITIONS OR CHANGES  
WHICH ARE SET FORTH  
HEREIN, IS ACCEPTED AS TO ITEMS:

31a. UNITED STATES OF AMERICA (SIGNATURE OF CONTRACTING OFFICER)

31c.	DATE
	SIGNED

Contracting Officer

Prescribed By GSA  
- FAR (48CFR) 53.212

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This Contract is Firm Fixed Price (FFP). The Contractor is required to provide the software, software license, and software maintenance services for the computer software identified below. Distribution of maintenance copies shall be accomplished by using an appropriate magnetic, electronic or printed media. Software maintenance includes periodic updates, enhancements and corrections to the software, and reasonable technical support, all of which are customarily provided by the Contractor to its customers.

The name of the software is: Word 2008  
License Type: Perpetual or Term?????  
Software Manufacturer: Microsoft

**Governing Law.** Federal law and regulations, including the Federal Acquisition Regulations ("FAR"), shall govern this Contract or Order (Contract/Order). Commercial license agreements may be made a part of this Contract/Order but only if both parties expressly make them an addendum. If the commercial license agreement is not made an addendum, it shall not apply, govern, be a part of or have any effect whatsoever on this Contract/Order; this includes, but is not limited to, any agreement embedded in the computer software (clickwrap) or any agreement that is otherwise delivered with or provided to the Government with the commercial computer software or documentation (shrinkwrap), or any other license agreement otherwise referred to in any document. If a commercial license agreement is made an addendum, only those provisions addressing data rights regarding the Government's use, duplication and disclosure of data (e.g., restricted computer software) are included and made a part of this Contract/Order, and only to the extent that those provisions are not duplicative or inconsistent with Federal law, Federal regulation or the incorporated FAR clauses; those provisions in the commercial license agreement that do not address data rights regarding the Government's use, duplication and disclosure of data shall not be included or made a part of the Contract/Order. Federal law and regulation, including without limitation, the Contract Disputes Act (41 U.S.C. §601-613), the Anti-Deficiency Act (31 U.S.C. §1341 et seq.), the Competition in Contracting Act (41 U.S.C. §251, et seq), the Prompt Payment Act (31 U.S.C. §3901, et seq.) and FAR clauses 52.212-4, 52.227-14, 52.227-19 shall supersede, control and render ineffective any inconsistent, conflicting or duplicative provision in any commercial license agreement. In the event of conflict between this clause and any provision in the Contract/Order or the commercial license agreement or elsewhere, the terms of this clause shall prevail. Claims of patent or copyright infringement brought against the Government as a party shall be defended by the U.S. Department of Justice (DOJ). 28 U.S.C. § 516. At the discretion of DOJ, the Contractor may be allowed reasonable participation in the defense of the litigation. Any additional changes to the Contract/Order must be made

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1	Microsoft Word 2008 Software License, Part No. 9891-7069. Software may be installed on four separate personal computers and be used by any VA employee or support service contractor. Licenses are perpetual.	4	EA	\$10,000.00	\$40,000.00
2	12 months of Standard Microsoft Word Software Maintenance and Technical Support Services for the software being acquired under CLIN 1; Part No. 9891-7069.	4	EA	\$2,500.00	\$10,000.00
	Total				\$50,000.00

32a. QUANTITY IN COLUMN 21 HAS BEEN  
☐ RECEIVED ☐ INSPECTED ☐ ACCEPTED, AND CONFORMS TO THE CONTRACT,  
EXCEPT AS NOTED:

32b. SIGNATURE OF AUTHORIZED GOVT. REPRESENTATIVE	32c. DATE	32d. PRINTED NAME AND TITLE OF AUTHORIZED GOVERNMENT REPRESENTATIVE
32e. MAILING ADDRESS OF AUTHORIZED GOVERNMENT REPRESENTATIVE		32f. TELEPHONE NO. OF AUTHORIZED GOVERNMENT REPRESENTATIVE
32g. E-MAIL OF AUTHORIZED GOVERNMENT REPRESENTATIVE		

33. SHIP NUMBER	34. VOUCHER NUMBER	35. AMOUNT VERIFIED CORRECT FOR	36. PAYMENT <input type="checkbox"/> COMPLETE <input type="checkbox"/> PARTIAL <input type="checkbox"/> FINAL	37. CHECK NUMBER
38. S/R ACCOUNT NUMBER	39. S/R VOUCHER NUMBER	40. PAID BY		

41a. I CERTIFY THIS ACCOUNT IS CORRECT AND PROPER FOR PAYMENT	42a. RECEIVED BY (Print)
41b. SIGNATURE AND TITLE OF CERTIFYING OFFICER	42b. RECEIVED AT (Location)
41c. DATE	42c. DATE REC'D (YY/MM/DD)
	42d. TOTAL CONTAINERS

STANDARD FORM

1449 (REV. 4/2002) BACK

ADDENDUM A -ADDITIONAL TERMS AND CONDITIONS FOR CONTRACT # \_\_\_\_\_ OR  
ORDER# \_\_\_\_\_

**A.1 Federal Acquisition Regulation (FAR) Incorporated by Reference.** The Contractor agrees to comply with the following FAR clauses, which the Contracting Officer has indicated as being incorporated in this Contract/Order by reference, to implement provisions of law or executive orders applicable to acquisitions of this nature, to implement department policy or to clarify the Government's requirement. Copies of clauses in full text will be provided on request. FAR Clauses can be viewed at <http://www.arinet.gov/far/>.



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- 1) FAR 52.212-4, Contract Terms and Conditions-Commercial Items (Oct 2003)
- 2) FAR 52.227-14, Rights in Data-General (Dec 2007), Alt III
- 3) FAR 52.227-16, Additional Data Requirements (Jun 1987)
- 4) FAR 52.227-19, Commercial Computer Software License (Dec 2007)

**A.2 Contracting Officer's Authority.** The Contracting Officer is the only person authorized to make or approve any changes in any of the requirements of this Contract, and notwithstanding any provisions contained elsewhere in this Contract/Order, the said authority remains solely within the Contracting Officer. In the event the Contractor makes any changes at the direction of any person other than the Contracting Officer, the changes will be considered to have been made without authority and no adjustment will be made in the contract price to cover any increase in costs incurred as a result thereof.

**A.3 VAAR 852.270-1 Representatives of Contracting Officers (APR 1984).** The Contracting Officer reserves the right to designate representatives to act for him/her in furnishing technical guidance and advice or generally supervise the work to be performed under this Contract/Order. Such designation will be in writing and will define the scope and limitations of the designee's authority. A copy of the designation shall be furnished the Contractor.

**A.4 VAAR 852.270-4 Commercial Advertising (NOV 1984).** The Contractor will not advertise the award of this Contract/Order in his/her commercial advertising in such a manner as to state or imply that the Department of Veterans Affairs endorses a product, project or commercial line of endeavor.

**A.5 VAAR 852.237-70 Contractor Responsibilities (APR 1984)** The Contractor shall obtain all necessary licenses and/or permits required to perform this work. He/she shall take all reasonable precautions necessary to protect persons and property from injury or damage during the performance of the Contract/Order. He/she shall be responsible for any injury to himself/herself, his/her employees, as well as for any damage to personal or public property that occurs during the performance of the Contract/Order that is caused by his/her employees fault or negligence, and shall maintain personal liability and property damage insurance having coverage for a limit as required by the laws of the state where services are performed. Further, it is agreed that any negligence of the Government, its officers, agents, servants and employees, shall not be the responsibility of the Contractor hereunder with the regard to any claims, loss, damage, injury, and liability resulting there from.

**A.6 Indemnification.** The Contractor shall save and hold harmless and indemnify the Government against any and all liability claims, and cost of whatsoever kind and nature for injury to or death of any person or persons and for loss or damage to any Contractor property or property owned by a third party occurring in connection with or in any way incident to or arising out of the occupancy, use service, operation, or performance of work under the terms of the Contract/Order, resulting in whole or in part from the acts or omissions of the Contractor, any subcontractor, or any employee, agent, or representative of the Contractor or subcontractor.

**A.7 Government's Liability.** The Government shall not be liable for any injury to the Contractor's personnel or damage to the Contractor's property

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unless such injury or damage is due to negligence on the part of the Government and is recoverable under the Federal Torts Claims Act, or pursuant to other Federal statutory authority.

**A.10 Uniform Computer Information Transaction Act (UCITA).** UCITA is not applicable to the Contract/Order.

**A.11 Software License and Software Maintenance Subscription and Technical Support.**

(1) Definitions.

- (a) Licensee. The term "licensee" shall mean the U.S. Department of Veterans Affairs ("VA") and is synonymous with "Government."
- (b) Licensor. The term "licensor" shall mean the software manufacturer of the computer software being acquired. The term "Contractor" is the company identified in Block 17a on the SF1449. If the Contractor is a reseller and not the Licensor, the Contractor remains responsible for performance under this Contract.
- (c) Software. The term "software" shall mean the licensed computer software product(s) cited in the Schedule of Supplies (Page 2).
- (d) Maintenance. The term "maintenance" is the process of enhancing and optimizing software, as well as remedying defects. It shall include all new fixes, patches, releases, updates, versions and upgrades, as further defined below.
- (e) Technical Support. The term "technical support" refers to the range of services providing assistance for the software via the telephone, email, a website or otherwise.
- (f) Release or Update. The term "release" or "update" are terms that refer to a revision of software that contains defect corrections, minor enhancements or improvements of the software's functionality. This is usually designated by a change in the number to the right of the decimal point (e.g., from Version 5.3 to 5.4). An example of an update is the addition of new hardware.
- (g) Version or Upgrade. The term "version" or "upgrade" are terms that refer to a revision of software that contains new or improved functionality. This is usually designated by a change in the number to the left of the decimal point (e.g., from Version 5.4 to 6).

(2) License. Grant of License and Term.

- (a) See also Addendum B.
- (b) Unless otherwise stated in the Schedule of Supplies/Services, the software license provided to the Government is a perpetual, nonexclusive license to use the software.
- (c) The license authorizes the Government to use the software in processing data for other federal agencies.
- (d) If the licensed software requires a password (or license key) to be operational, it shall be delivered with the software media and have no expiration date.
- (e) If the Government decides to outsource or contract its services, the Government may allow the outsourcer to use the licensed software solely to provide the services on its behalf. The

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outsourcer shall be bound by the provisions of this Contract relating to the use of the software.

- (f) If the software is for use in a networked environment, as may be reflected by the number of servers or users described in the Contract/Order, the license grant provided by the Contractor includes the Government's use of the software in such environment.
- (g) Any dispute regarding the license grant or usage limitations shall be resolved in accordance with the Disputes Clause incorporated in FAR 52.212-4(d).
- (h) If the Government purchases additional licenses, the terms and conditions for those additional licenses (including technical support and upgrade subscription) shall be the same as agreed to in this Contract/Order, unless negotiated otherwise by mutual agreement of the parties.
- (i) The licensed software contains critical product functionality that meets the minimum needs of the Government and is the basis for the Government's procurement of the software; consequently, the Contractor agrees that the Government has the right to successor products at no additional cost when functionality is later unbundled from the product licensed herein and bundled into a new or different product, provided the Government is current on maintenance.
- (j) If the Contractor is a reseller for the computer software being acquired under this Contract/Order, it is permissible for the actual software manufacturer (Licensor) to deliver the software directly to the Government.
- (k) All limitations of software usage are expressly stated in the SF 1449 and Addendum A and Addendum B.

**(3) Software Maintenance Subscription and Technical Support.**

- (a) See also Addendum B.
- (b) Software maintenance and technical support are included at the agreed upon price. However, if additional charges are assessed during the maintenance and technical support period as a result of negotiated changes in the license (e.g., CPU upgrades), the fee shall be by mutual agreement of the parties and any dispute thereof shall be resolved in accordance with the Disputes Clause incorporated herein at FAR 52.212-4(g).
- (c) If the Government desires to continue software maintenance and support beyond the period identified in this Contract/Order, the Government will issue a separate contract or order to renew annual maintenance and technical support. Conversely, if an order or contract to renew software maintenance and technical support is not received, no assumption by the Contractor shall be made that it has been renewed. It shall not be automatically renewed.
- (d) Unless otherwise agreed, for any new additional software that may be licensed, the Contractor shall provide for software maintenance and technical support for the first year of the license at no additional cost.
- (e) Unless otherwise agreed, the Contractor shall provide VA with software maintenance, which includes periodic updates, upgrades, enhancements and corrections to the software, and reasonable technical support, all of which are customarily provided by the

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- Contractor to its customers so as to cause the software to perform according to its specifications, documentation or demonstrated claims.
- (f) Any telephone support provided by Contractor shall be at no additional cost.
  - (g) All technical support services will be provided in a timely manner in accordance with the Contractor's customary practice. However, prolonged delay in resolving software problems will be noted in the Government's various past performance records on the Contractor (e.g., [www.ppirs.gov](http://www.ppirs.gov)).
  - (h) If the Government allows the maintenance and/or technical support to lapse and subsequently wishes to reinstate maintenance and technical support, any reinstatement fee charged shall not exceed the amounts that would have been charged if the Government had not allowed it to lapse.

**A.12 Disabling Software Code.** The Government requires delivery of computer software that does not contain any code that will, upon the occurrence or the nonoccurrence of any event, disable the software. Such code includes but is not limited to a computer virus, restrictive key, node lock, time-out or other function, whether implemented by electronic, mechanical, or other means, which limits or hinders the use or access to any computer software based on residency on a specific hardware configuration, frequency of duration of use, or other limiting criteria. If any such code is present, the Contractor agrees to indemnify the Government for all damages suffered as a result of a disabling caused by such code, and the Contractor agrees to remove such code upon the Government's request at no extra cost to the Government. Inability of the Contractor to remove the disabling software code will be considered an inexcusable delay and a material breach of contract, and the Government may exercise its right to terminate for cause. In addition, the Government is permitted to remove the code as it deems appropriate and charge the Contractor for consideration for the time and effort in removing the code.

**A.13 Disaster Recovery Clause.** Government hereby certifies to Contractor that it has a bona fide disaster plan with respect to the computer software programs used in its operations. The Contract/Order authorizes the Government's operation to maintain a second copy of software on tape for use at loading at sites that are not live (e.g. subscription-based disaster recovery services) for the sole purpose of duplicating or mirroring the software environment of the "primary" licenses at the designated licensed site and as described herein. Additionally, use of the software at the contingency sites must not include general access or any processing for program development or production. Contractor shall permit operation and testing of all licensed programs at the contingency sites as designated by the Government without prior approval and at no additional cost to the Government solely for the purpose of maintaining or implementing disaster recovery readiness including continuity of business operations. CPU's, MIPS or MSU's at these contingency sites are excluded from the total CPU's, MIPS or MSU's count included elsewhere in the Contract/Order and are not separately billable. Activation of operations at a contingency site shall be at Government's discretion. Government is authorized to install all software at the contingency sites for testing, problem resolution purposes, and to ensure there will be no operational delays in association with transition of workload from the designated licensed site to the contingency sites. Use of the software at the contingency sites in the event of a disaster shall

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continue until such time as normal processing can be resumed at the "primary" site regardless of the duration required. Nothing in the Contract/Order diminishes the Government's rights in accordance with the data rights clause(s). Any license keys, codes, or passwords required by the Contractor in order to use the software at the contingency sites shall be provided to the Government within 10 days of the Government's request.

**A.14 NOTICE OF THE FEDERAL ACCESSIBILITY LAW AFFECTING ALL ELECTRONIC AND INFORMATION TECHNOLOGY PROCUREMENTS (SECTION 508)**

On August 7, 1998, Section 508 of the Rehabilitation Act of 1973 was amended to require that when Federal departments or agencies develop, procure, maintain, or use Electronic and Information Technology, that they shall ensure it allows Federal employees with disabilities to have access to and use of information and data that is comparable to the access to and use of information and data by other Federal employees.

Section 508 required the Architectural and Transportation Barriers Compliance Board (Access Board) to publish standards setting forth a definition of electronic and information technology and the technical and functional criteria for such technology to comply with Section 508. These standards have been developed were published with an effective date of December 21, 2000. Federal departments and agencies must develop all Electronic and Information Technology requirements to comply with the standards found in 36 CFR 1194 .\_\_\_\_\*\_\_\_\_ in performing this contract. (Fill in Section Number and Title)

**ADDENDUM B - STATEMENT OF WORK FOR CONTRACT # \_\_\_\_\_ or  
ORDER# \_\_\_\_\_**

**B.1 License.** BROADLY DESCRIBE COMPUTING ENVIRONMENT AND HOW VA INTENDS TO USE THE SOFTWARE, HOW ITS LICENSED, WHAT THE SOFTWARE IS EXPECTED TO DO, ETC. TO GET YOU STARTED: The Department of Veterans Affairs (VA) has a need for the computer software identified on the Schedule of Supplies/Services (page 2) (software media and license) and software support services. The software will be installed **onto multiple servers** at the ITAC in Austin Texas for support/training/staging of the \_\_\_\_\_ Project. These are processor-based licenses that allow for unlimited users utilizing the processor(s). Contractor shall grant the Government the necessary license to accommodate this need. VA may move the software to any other location or hardware at any time.

**B.2 Maintenance.** The Contractor will provide software maintenance services, which includes periodic updates, enhancements and corrections to the software, and reasonable technical support, all of which are customarily provided by the Contractor to its customers so as to cause the software to perform according to its specifications, documentation or demonstrated claims. **Add detailed, specific maintenance and support information here.** The Contractor will distribute maintenance updates or releases by using an appropriate magnetic, electronic, or printed media to the address in Block 15 of page one, but to the attention of **Joe Smith**. Alternatively, the Contractor may offer access to maintenance copies through its website. All maintenance services will be provided in a timely manner in accordance with the Contractor's customary practice. However, prolonged delay in resolving

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software problems will be noted in the Government's various past performance records on the Contractor (e.g., [www.ppirs.gov](http://www.ppirs.gov)).

## 2. MOU

Department of  
Veterans Affairs

Memorandum

- Date:** (Current Date)
- From:** Department of Veterans Affairs  
Office of Telecommunications (005OP)  
Spectrum Management (005OP2H3 – Room 047))  
Telecommunications Voice Engineering (005OP2H2)  
810 Vermont Avenue, NW  
Washington, DC 20420
- Subj:** Memorandum of Understanding (MOU) for Non - VA Licensed Wireless Operations
- To:** Facility Director (00)  
(Address)  
(Address)
1. The following circumstances are the minimum necessary for conditional use of Wireless Equipment / System (s) in VA Owned or Leased Facilities (here-in after referred to as 'the Facility'). VA Headquarters OI&T's (005) Spectrum Management (005OP2H3), Telecommunications Voice Engineering, Special Communications (TVE - 005OP2H2) and Office of Cyber Security (OCIS – 0050P2) are the responsible entities insuring conformity of each requirement:
    - a. Each item of equipment or system whose Radio Frequency (RF) equipment is listed under Consolidated Federal Regulations (CFR), Title 47 – Federal Communications Commission (FCC), Part 15, Chapter 7, Use of Non Licensed Devices must be installed and operated in a manner consistent with Part 15's "Safety of Life" restrictions. This information is re-emphasized in CFR, Title 15 – Department of Commerce, Under the Information Technology Management Reform Act (Public Law 104-106), National Telecommunications Information Administration (NTIA) Manual of Regulations and Procedures for Federal Radio Frequency Management (aka 'The Red Book').
    - b. FCC Part 15 listed RF devices ***shall not*** be Installed or used in areas where "Safety of Life" functions / operations are accomplished or where a 'Code Blue' enunciation may occur. A list of the minimum areas affected by this statement is provided as Attachment One.
    - c. If external or internal interference is detected and cannot be corrected, ***the FCC Part 15 Listed RF Equipment affected must be turned off until corrections and/or substitutions can be made.*** Contact VA's Office of Spectrum Management (OSM – 005OP2H3), 202 461-5301 for specific conditional approval(s) concerning this issue.

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### 3. Risk Assessment

Department of  
Veterans Affairs

Memorandum

**Date:** (current date)

**From:** Director (XXXXX)  
Address  
Address  
Address

**Subj:** VA Headquarters (VACO) Memorandum of Understanding (MOU) for  
Federal Communications Commission (FCC) Part 15 Listed "Non-Regulated  
Equipment Wireless Operations"

**To:** Department of Veterans Affairs  
Office of Telecommunications (005OP)  
Spectrum Management (005OP2H3)  
Telecommunications Voice Engineering (005OP2H2)  
1335 East West Highway, 3<sup>rd</sup> Floor  
Silver Spring, Maryland 20420

1. We have received the subject VACO MOU (signed copy attached), and are pleased to provide the following information and comments for your review that includes our risks and risk-mitigation factors that prompted our Facility's decision:

a. RISK ASSESSMENT AND MITIGATION:

(1) Background:

(a) (name) VAMC (here-in-after referred to as "the Facility") has used (OEM Mdl Nr©) for over 10 years to allow nurses in the telemetry studio to communicate with nurses at the patients' bedside. This communication medium is a vital patient safety tool that allows for rapid response to the development of a potentially fatal arrhythmia such as ventricular tachycardia. The only information the telemetry technician states on the phone is "bed 109-2 Smith has an alarm for XXXXX." Last four is never communicated. In terms of the pager we have limited the information on the pager to sector, bed number and last name. We must include the last name as occasionally the patients are moved without the knowledge of the telemetry technician, if we were to have a patient mix up the page must contain the last name for safety reasons. Facility Management Services (FMS) has restricted paging access to the telemetry system only. Because pager access is restricted, only an administrator from Technology and Information Management (TIM) or FMS can troubleshoot a pager malfunction.



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VAMC (City), (State - ZIP Code), Unregulated FCC Equipment Use, Risk Assessment and Mitigation, Page Two

(b) Because the phones are used 24X7 and have exceeded their life expectancy, many of them have begun to fail which creates a need to purchase newer models that will continue to insure system integrity.

(c) Our Facility has been prevented from purchasing replacement phones because VACO now has updated security and Information Technology (IT) connection controls along with continuing FCC Part 15 restrictions (described in the attached MOU) on devices of which these wireless phones are but one example. These updated security and connection controls are in place to address risks related life safety, information security, personal privacy and IT system integrity. The FCC restrictions continue to warn against the use of "non-regulated radio / wireless based equipment in safety of life locations and functions." Of note, these controls are intended to prevent use of these devices in areas especially where a code-blue announcement might occur, yet our devices have been used in such areas for over 10 years and so far has not prevented a code-blue announcement from happening.

(d) Because the Facility does not have a near-term alternative to the current wireless phones, it now faces a set of competing risks. On the one hand are the risks of privacy, connection and interference or security breach(s) that are behind the controls in place for these devices. On the other hand are risks to patient safety if the current phones were to fail and telemetry nurses would lose the ability to rapidly communicate with nurses at the bedside. Our Facility does have a Life Safety approved Nurses Call / Code Blue hardwired system that is installed in those affected areas as the primary Code Blue Enunciation media.

(2) SECURITY:

(a) NEC provides a proprietary scrambling algorithm that is applied to handset registration / authentication and all communications. Every time a (OEM Mdl Nr©) user enters a designated area within the systems' coverage; an automatic user authentication process is performed to confirm the device is authorized for service on the system. This information is scrambled using a proprietary coding scheme to prevent duplication. All voice conversations are also scrambled to enhance security.

(b) The (OEM Mdl Nr©) has several built in security features in each of the wireless handsets are administered through the Facility's Telephone Private Branch Exchange (PBX) administration tool; therefore, the PBX Administrator has full control over the (OEM Mdl Nr©) wireless phones, if one gets lost or stolen it can be disabled immediately. Because of this feature you cannot purchase a similar wireless phone and have it work on our network. These phones have a 50 ft radius from the Zone radio frequency (RF) transceiver; they can only be used within the hospital as there is no handoff via other cellular networks.

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(c) These items are not NIST FIPS compliant; but based on the aforementioned facts, we feel patient / staff privacy and HIPAA instructions have been and will continue to be met.

(d) Our Facility will work with (OEM) and VACO's Office of Cyber Security (Name and Phone Nr) to secure the appropriate NIST FIPS certifications will allow VA to issue a Official Approvals from the onset in the IT equipment / system procurement process.

VAMC (City), (State - ZIP Code), Unregulated FCC Equipment Use, Risk Assessment and Mitigation, Page Three

(3) RADIO FREQUENCY (RF) INTERFERENCE:

(a) (OEM) engineers provided us with extensive information on the potential for RF along with electromagnetic (EM) interference to medical equipment within our Facility from the (OEM System) Wireless radio transceivers.

1) Field Experience: Since introduction of the (OEM System) Wireless product in 1996, NEC has installed this system at many health care institutions across the spectrum of medical departments. In all this time there have been zero reports of either suspected or actual RF and EM interference. This includes the experience using these devices at Portland VAMC and our continued testing documentation is available for review if requested.

2) Potential interference called Near Field Coupling: In these cases, an EM field emanating from one device may cause another device within its field area to malfunction. Typically the distances for these fields are less than six (6) inches. In attempts to mitigate these sources of interference, standards have been put in place, namely IEC 60601. This standard calls for devices susceptible to interference to provide shielding against fields of up to three (3) Volts per Meter. In contrast, the (OEM System) wireless products are classified under the FCC Part 15 rules as Class B unlicensed devices, and as such must meet very tight restrictions regarding field emissions of a maximum of from 100 to 500 micro ( $\mu$ ) Volts per Meter across the band of RFs from 30 Hz to 18 GHz. Thus, any medical device even marginally meeting the IEC Standard has not had problems with any near field emissions.

3) Potential phenomenon known as Far Field Induced RFI: should be considered when studying RF and EM interference sources. In this case, a part of the device subject to interference (e.g., a wire, probe, or the casing itself) can inadvertently act as a receiving antenna for a signal transmitted from another device within close proximity (within 6 to 18 inches, depending on the source power levels). To realize this type of interference, the source transmitter power must be fairly strong to conduct through the inefficient nature of the unintended antenna of the receiving device, and the material acting as the antenna must be of a shape and length that matches or is a near multiple of the wavelength of the transmitted RF signal. Finally, this unintentional antenna must not have the typical shielding between it and the subject device's electronics, which if

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present would prevent such a received signal from causing interference. In the case of the (OEM System) Wireless transmission, which operates between 1,920 MHz and 1,930 MHz, a probe or such piece of any medical device measuring at about six (6) inches would match the wavelength of the RF carrier, and if not properly shielded from the units electronics may indeed conduct the RF energy within. However, even in this case, one must consider the power level at the so-called antenna receiving the signal. The average output of the (OEM Mdl Nr©) handset is approximately 10 mili (m) Watts when in use. This very low power, even further reduced by the distance between any handset in use and the subject receiving equipment, considered along with the high loss of the "antenna", results in a very low probability of actual interference. These facts, along with the standard procedures of your engineering department's efforts to check the medical equipment for such shielding and filtering defects, should mitigate this potential source.

4) Potential interference between intentional radiators operating in the RF band. Known as either in-band or out-of-band interference, these are cases where a transmitter broadcasts a signal of significant power at the other device's receiver to either overload the receiving radio or mix with the subject's transmitted signal to cause an interfered signal to be received. In-band interference

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in the Unlicensed PCS band of which the (OEM System) Wireless system operates is prevented by the FCC rules requiring our equipment to monitor the carrier on which a device intends to transmit on before doing so, so as to sense any current use by another device. If such a signal is received during monitoring, we move to another carrier and try again. This protocol has been demonstrated many times within the FCC labs as well as at many industry trade shows where 5 or more vendors with U-PCS devices have operated in booths close to each other without interference. As for out-of-band interference, because of the extremely low power our devices operate with and the very strict out-of-band emission requirements placed upon the U-PCS devices, and the additional factor of a wide separation in the operating frequencies of our system and the typical radio telemetry equipment used in many hospital environments, such interference is very remote and would require extremely close proximity of the two devices.

5) All of our (OEM Mdl Nr©) are FCC listed and has not interfered with other traffic within the same band. We expect the FCC listed (OEM Mdl Nr©) equipment will perform in the same manner.

(b) Our Facility will work with (OEM) and VACO's Spectrum Management (0050P2H3) to find a RF band that can be utilized for this operation that will allow VA to issue a formal and Official Radio Use Permit that will negate the "unregulated equipment use" issues.

(4) CONNECTION TO IT/CABLE NETWORKS:

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(a) Each item or system that attaches to a VA IT Network (telephone or data) must be Department of Commerce's National Recognized Testing Laboratory (NRTL) Underwriters Laboratory (UL) 60950-1/2; Information Technology Equipment - Safety listed and bears UL's mark.

1) Paragraph 1.1.1; Equipment Covered by this Standard specifically identifies these systems / networks as one affected system.

2) Paragraph 1.1.2; Additional Requirements further identifies this requirement for electromedical applications with physical connections to the patient be met.

(b) This requirement is paramount since the Facility's Telephone PABX and associated system is listed by the National Fire Protection Association as Critical Service. Additionally, since it carries our Code Blue Radio and Overhead Audio Paging Signals, VA elevates it to Life Safety Service.

(c) Presently the (OEM Mdl Nr©) wireless phones are UL Listed but does not have the aforementioned specific UL certification. Our Facility is working with (The OEM) in this arena to have them meet or exceed this UL requirement. In the meantime we will abide within the confines outlined in the attached MOU for insuring an approved IT Network / System connection is maintained until the appropriate UL certification has been obtained allowing it to be directly connected to our telephone system.

b. The Facility Director after careful review of the attached MOU and consultation with the Facility's CIO, (OEM) engineers, Biomedical and NFPA Engineers, ISO, HIPAA / Privacy Officer, Clinical Staff and JACHAO Officials has decided this risk-benefit analysis strongly favors purchasing replacement (OEM Mdl Nr) phones.

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2. Please feel free to contact me concerning the contents of this document.

DIRECTOR's NAME IN CAPS

cc: Office of General Counsel  
Office of Telecommunications (05)  
VA Enterprise Infrastructure Engineering  
Telecommunications Engineering and Design  
Office of Cyber Security

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Attachment: VACO MOU

- - - E N D - - -

SECTION 28 05 00  
COMMON WORK RESULTS FOR ELECTRONIC SAFETY AND SECURITY

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This Section, Common Work Results for Electronic Safety and Security (ESS), applies to all sections of Division 28.
- B. Furnish and install fully functional electronic safety and security cabling system(s), equipment and approved accessories in accordance with the specification section(s), drawing(s), and referenced publications. Capacities and ratings of cable and other items and arrangements for the specified items are shown on each system's required Bill of Materials (BOM) and verified on the approved system drawing(s). If there is a conflict between contract's specification(s) and drawings(s), the contract's specification requirements shall prevail.
- C. The Contractor shall provide a fully functional and operating ESS, programmed, configured, documented, and tested as required herein and the respective Safety and Security System Specification(s). The Contractor shall provide calculations and analysis to support design and engineering decisions as specified in submittals. The Contractor shall provide and pay all labor, materials, and equipment, sales and gross receipts and other taxes. The Contractor shall secure and pay for plan check fees, permits, other fees, and licenses necessary for the execution of work as applicable for the project. Give required notices; the Contractor will comply with codes, ordinances, regulations, and other legal requirements of public authorities, which bear on the performance of work.
- D. The Contractor shall provide an ESS, installed, programmed, configured, documented, and tested. The security system shall include but not limited to: physical access control, intrusion detection, duress alarms, elevator control interface, video assessment and surveillance, video recording and storage, delayed egress, personal protection system, intercommunication system, fire alarm interface, equipment cabinetry, dedicated photo badging system and associated live camera, report printer, photo badge printer, and uninterruptible power supplies (UPS) interface. Operator training shall not be required as part of the Security Contractors scope and shall be provided by the VAMC. The Security Contractor shall still be required to provide necessary maintenance and troubleshooting manuals as well as submittals as identified herein. The work shall include the procurement and installation of electrical wire and cables, the installation and testing

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of all system components. Inspection, testing, demonstration, and acceptance of equipment, software, materials, installation, documentation, and workmanship, shall be as specified herein. The Contractor shall provide all associated installation support, including the provision of primary electrical input power circuits.

- E. Repair Service Replacement Parts On-site service during the warranty period shall be provided as specified under "Emergency Service". The Contractor shall guarantee all parts and labor for a term of one (1) year, unless dictated otherwise in this specification from the acceptance date of the system as described in Part 5 of this Specification. The Contractor shall be responsible for all equipment, software, shipping, transportation charges, and expenses associated with the service of the system for one (1) year. The Contractor shall provide 24-hour telephone support for the software program at no additional charge to the VAMC. Software support shall include all software updates that occur during the warranty period.

F. Section Includes:

1. Description of Work for Electronic Security Systems,
2. Electronic security equipment coordination with relating Divisions,
3. Submittal Requirements for Electronic Security,
4. Miscellaneous Supporting equipment and materials for Electronic Security,
5. Electronic security installation requirements.

**1.2 RELATED WORK**

- A. Section 01 00 00 - GENERAL REQUIREMENTS. For General Requirements.
- B. Section 07 84 00 - FIRESTOPPING. Requirements for firestopping application and use.
- C. Section 08 71 00 - DOOR HARDWARE. Requirements for door installation.
- D. Section 10 14 00 - SIGNAGE. Requirements for labeling and signs.
- E. Section 26 05 11 - REQUIREMENTS FOR ELECTRICAL INSTALLATIONS. Requirements for connection of high voltage.
- F. Section 26 05 21 - LOW VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES (600 VOLTS AND BELOW). Requirements for power cables.
- G. Section 26 05 33 - RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS. Requirements for infrastructure.
- H. Section 28 05 13 - CONDUCTORS AND CABLES FOR ELECTRONIC SAFETY AND SECURITY. Requirements for conductors and cables.
- I. Section 28 05 26 - GROUNDING AND BONDING FOR ELECTRONIC SAFETY AND SECURITY. Requirements for grounding of equipment.

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- J. Section 28 05 28.33 - CONDUITS AND BOXES FOR ELECTRONIC SAFETY AND SECURITY. Requirements for infrastructure.
- K. Section 28 13 00 - PHYSICAL ACCESS CONTROL SYSTEMS (PACS). For physical access control integration.
- L. Section 28 23 00 - VIDEO SURVEILLANCE. Requirements for security camera systems.
- M. Section 28 26 00 - ELECTRONIC PERSONAL PROTECTION SYSTEM (EPPS). Requirements for emergency and interior communications.

**1.3 DEFINITIONS**

- A. AGC: Automatic Gain Control.
- B. Basket Cable Tray: A fabricated structure consisting of wire mesh bottom and side rails.
- C. BICSI: Building Industry Consulting Service International.
- D. CCD: Charge-coupled device.
- E. Central Station: A PC with software designated as the main controlling PC of the security access system. Where this term is presented with initial capital letters, this definition applies.
- F. Channel Cable Tray: A fabricated structure consisting of a one-piece, ventilated-bottom or solid-bottom channel section.
- G. Controller: An intelligent peripheral control unit that uses a computer for controlling its operation. Where this term is presented with an initial capital letter, this definition applies.
- H. CPU: Central processing unit.
- I. Credential: Data assigned to an entity and used to identify that entity.
- J. DGP: Data Gathering Panel - component of the Physical Access Control System capable to communicate, store and process information received from readers, reader modules, input modules, output modules, and Security Management System.
- K. DTS: Digital Termination Service: A microwave-based, line-of-sight communications provided directly to the end user.
- L. EMI: Electromagnetic interference.
- M. EMT: Electric Metallic Tubing.
- N. ESS: Electronic Security System.
- O. File Server: A PC in a network that stores the programs and data files shared by users.
- P. GFI: Ground fault interrupter.
- Q. IDC: Insulation displacement connector.
- R. Identifier: A credential card, keypad personal identification number or code, biometric characteristic, or other unique identification entered



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as data into the entry-control database for the purpose of identifying an individual. Where this term is presented with an initial capital letter, this definition applies.

- S. I/O: Input/Output.
- T. Intrusion Zone: A space or area for which an intrusion must be detected and uniquely identified, the sensor or group of sensors assigned to perform the detection, and any interface equipment between sensors and communication link to central-station control unit.
- U. Ladder Cable Tray: A fabricated structure consisting of two longitudinal side rails connected by individual transverse members (rungs).
- V. LAN: Local area network.
- W. LCD: Liquid-crystal display.
- X. LED: Light-emitting diode.
- Y. Location: A Location on the network having a PC-to-Controller communications link, with additional Controllers at the Location connected to the PC-to-Controller link with RS-485 communications loop.  
Where this term is presented with an initial capital letter, this definition applies.
- Z. Low Voltage: As defined in NFPA 70 for circuits and equipment operating at less than 50 V or for remote-control and signaling power-limited circuits.
- AA. M-JPEG: Motion - Joint Photographic Experts Group.
- BB. MPEG: Moving picture experts group.
- CC. NEC: National Electric Code
- DD. NEMA: National Electrical Manufacturers Association
- EE. NFPA: National Fire Protection Association
- FF. NTSC: National Television System Committee.
- GG. NRTL: Nationally Recognized Testing Laboratory.
- HH. Open Cabling: Passing telecommunications cabling through open space (e.g., between the studs of a wall cavity).
- II. PACS: Physical Access Control System; A system comprised of cards, readers, door controllers, servers and software to control the physical ingress and egress of people within a given space
- JJ. PC: Personal computer. This acronym applies to the Central Station, workstations, and file servers.
- KK. PCI Bus: Peripheral component interconnect; a peripheral bus providing a high-speed data path between the CPU and peripheral devices (such as monitor, disk drive, or network).

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- LL. PDF: (Portable Document Format.) The file format used by the Acrobat document exchange system software from Adobe.
- MM. RCDD: Registered Communications Distribution Designer.
- NN. RFI: Radio-frequency interference.
- OO. RIGID: Rigid conduit is galvanized steel tubing, with a tubing wall that is thick enough to allow it to be threaded.
- PP. RS-232: An TIA/EIA standard for asynchronous serial data communications between terminal devices. This standard defines a 25-pin connector and certain signal characteristics for interfacing computer equipment.
- QQ. RS-485: An TIA/EIA standard for multipoint communications.
- RR. Solid-Bottom or Non-ventilated Cable Tray: A fabricated structure consisting of integral or separate longitudinal side rails, and a bottom without ventilation openings.
- SS. SMS: Security Management System - A SMS is software that incorporates multiple security subsystems (e.g., physical access control, intrusion detection, closed circuit television, intercom) into a single platform and graphical user interface.
- TT. TCP/IP: Transport control protocol/Internet protocol incorporated into Microsoft Windows.
- UU. Trough or Ventilated Cable Tray: A fabricated structure consisting of integral or separate longitudinal rails and a bottom having openings sufficient for the passage of air and using 75 percent or less of the plan area of the surface to support cables.
- VV. UPS: Uninterruptible Power Supply
- XX. UTP: Unshielded Twisted Pair
- YY. Workstation: A PC with software that is configured for specific limited security system functions.

**1.4 QUALITY ASSURANCE**

- A. Manufacturers Qualifications: The manufacturer shall regularly and presently produce, as one of the manufacturer's principal products, the equipment and material specified for this project, and shall have manufactured the item for at least three years.
- B. Product Qualification:
1. Manufacturer's product shall have been in satisfactory operation, on three installations of similar size and type as this project, for approximately three years.
  2. The Government reserves the right to require the Contractor to submit a list of installations where the products have been in operation before approval.
- C. Contractor Qualification:

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1. The Contractor or security sub-contractor shall be a licensed security Contractor with a minimum of five (5) years' experience installing and servicing systems of similar scope and complexity. The Contractor shall be an authorized regional representative of the Security Management System's (PACS) manufacturer. The Contractor shall provide four (4) current references from clients with systems of similar scope and complexity which became operational in the past three (3) years. At least three (3) of the references shall be utilizing the same system components, in a similar configuration as the proposed system. The references must include a current point of contact, company or agency name, address, telephone number, complete system description, date of completion, and approximate cost of the project. The Resident Engineer reserves the option to visit the reference sites, with the site Resident Engineer's permission and representative, to verify the quality of installation and the references' level of satisfaction with the system. The Contractor shall provide copies of system manufacturer certification for all technicians. The Contractor shall only utilize factory-trained technicians to install, program, and service the PACS. The Contractor shall only utilize factory-trained technicians to install, terminate and service controller/field panels and reader modules. The technicians shall have a minimum of five (5) continuous years of technical experience in electronic security systems. The Contractor shall have a local service facility. The facility shall be located within [60] <insert number> miles of the project site. The local facility shall include sufficient spare parts inventory to support the service requirements associated with this contract. The facility shall also include appropriate diagnostic equipment to perform diagnostic procedures. The Resident Engineer reserves the option of surveying the company's facility to verify the service inventory and presence of a local service organization.
2. The Contractor shall provide proof project superintendent with BICSI Certified Commercial Installer Level 1, Level 2, or Technician to provide oversight of the project.
3. Cable installer must have on staff a Registered Communication Distribution Designer (RCDD) certified by Building Industry Consulting Service International. The staff member shall provide consistent oversight of the project cabling throughout design, layout, installation, termination and testing.

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- D. Service Qualifications: There shall be a permanent service organization maintained or trained by the manufacturer which will render satisfactory service to this installation within four hours of receipt of notification that service is needed. Submit name and address of service organizations.

**1.5 GENERAL ARRANGEMENT OF CONTRACT DOCUMENTS**

- A. The Contract Documents supplement to this specification indicates approximate locations of equipment. The installation and/or locations of the equipment and devices shall be governed by the intent of the design; specification and Contract Documents, with due regard to actual site conditions, recommendations, ambient factors affecting the equipment and operations in the vicinity. The Contract Documents are diagrammatic and do not reveal all offsets, bends, elbows, components, materials, and other specific elements that may be required for proper installation. If any departure from the contract documents is deemed necessary, or in the event of conflicts, the Contractor shall submit details of such departures or conflicts in writing to the Resident Engineer for his or her comment and/or approval before initiating work.
- B. Anything called for by one of the Contract Documents and not called for by the others shall be of like effect as if required or called by all, except if a provision clearly designed to negate or alter a provision contained in one or more of the other Contract Documents shall have the intended effect. In the event of conflicts among the Contract Documents, the Contract Documents shall take precedence in the following order: the Form of Agreement; the Supplemental General Conditions; the Special Conditions; the Specifications with attachments; and the drawings.

**1.6 SUBMITTALS**

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. The Government's approval shall be obtained for all equipment and material before delivery to the job site. Delivery, storage or installation of equipment or material which has not had prior approval will not be permitted at the job site.
- C. Submittals for individual systems and equipment assemblies which consist of more than one item or component shall be made for the system or assembly as a whole. Partial submittals will not be considered for approval.
1. Mark the submittals, "SUBMITTED UNDER SECTION\_\_\_\_\_".
  2. Submittals shall be marked to show specification reference including the section and paragraph numbers.

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3. Submit each section separately.
- D. The submittals shall include the following:
1. Information that confirms compliance with contract requirements.  
Include the manufacturer's name, model or catalog numbers, catalog information, technical data sheets, shop drawings, pictures, nameplate data and test reports as required.
  2. Submittals are required for all equipment anchors and supports.  
Submittals shall include weights, dimensions, center of gravity, standard connections, manufacturer's recommendations and behavior problems (e.g., vibration, thermal expansion,) associated with equipment or piping so that the proposed installation can be properly reviewed.
  3. Parts list which shall include those replacement parts recommended by the equipment manufacturer, quantity of parts, current price and availability of each part.
- E. Submittals shall be in full compliance of the Contract Documents. All submittals shall be provided in accordance with this section. Submittals lacking the breadth or depth these requirements will be considered incomplete and rejected. Submissions are considered multidisciplinary and shall require coordination with applicable divisions to provide a complete and comprehensive submission package. All submittals shall include adequate descriptive literature, catalog cuts, shop drawings and other data necessary for the Government to ascertain that the proposed equipment and materials comply with specification requirements. Catalog cuts submitted for approval shall be legible and clearly identify equipment being submitted. Additional general provisions are as follows:
1. The Contractor shall schedule submittals in order to maintain the project schedule. For coordination drawings refer to Specification Section 01 33 10 - Design Submittal Procedures, which outline basic submittal requirements and coordination. Section 01 33 10 shall be used in conjunction with this section.
  2. The Contractor shall identify variations from requirements of Contract Documents and state product and system limitations, which may be detrimental to successful performance of the completed work or system.
  3. Each package shall be submitted at one (1) time for each review and include components from applicable disciplines (e.g., electrical work, architectural finishes, door hardware, etc.) which are required to produce an accurate and detailed depiction of the project.

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4. Manufacturer's information used for submittal shall have pages with items for approval tagged, items on pages shall be identified, and capacities and performance parameters for review shall be clearly marked through use of an arrow or highlighting. Provide space for Resident Engineer and Contractor review stamps.
5. Technical Data Drawings shall be in the latest version of AutoCAD®, drawn accurately, and in accordance with VA CAD Standards CAD Standard Application Guide, and VA BIM Guide. FREEHAND SKETCHES OR COPIED VERSIONS OF THE CONSTRUCTION DOCUMENTS WILL NOT BE ACCEPTED. The Contractor shall not reproduce Contract Documents or copy standard information as the basis of the Technical Data Drawings. If departures from the technical data drawings are subsequently deemed necessary by the Contractor, details of such departures and the reasons thereof shall be submitted in writing to the Resident Engineer for approval before the initiation of work.
6. Packaging: The Contractor shall organize the submissions according to the following packaging requirements.
  - a. Binders: For each manual, provide heavy duty, commercial quality, durable three (3) ring vinyl covered loose leaf binders, sized to receive 8.5 x 11 in paper, and appropriate capacity to accommodate the contents. Provide a clear plastic sleeve on the spine to hold labels describing the contents. Provide pockets in the covers to receive folded sheets.
    - 1) Where two (2) or more binders are necessary to accommodate data; correlate data in each binder into related groupings according to the Project Manual table of contents. Cross-referencing other binders where necessary to provide essential information for communication of proper operation and/or maintenance of the component or system.
    - 2) Identify each binder on the front and spine with printed binder title, Project title or name, and subject matter covered. Indicate the volume number if applicable.
  - b. Dividers: Provide heavy paper dividers with celluloid tabs for each Section. Mark each tab to indicate contents.
  - c. Protective Plastic Jackets: Provide protective transparent plastic jackets designed to enclose diagnostic software for computerized electronic equipment.
  - d. Text Material: Where written material is required as part of the manual use the manufacturer's standard printed material, or if not

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available, specially prepared data, neatly typewritten on 8.5 inches by 11 inches 20 pound white bond paper.

e. Drawings: Where drawings and/or diagrams are required as part of the manual, provide reinforced punched binder tabs on the drawings and bind them with the text.

- 1) Where oversized drawings are necessary, fold the drawings to the same size as the text pages and use as a foldout.
- 2) If drawings are too large to be used practically as a foldout, place the drawing, neatly folded, in the front or rear pocket of the binder. Insert a type written page indicating the drawing title, description of contents and drawing location at the appropriate location of the manual.
- 3) Drawings shall be sized to ensure details and text is of legible size. Text shall be no less than 1/16" tall.

f. Manual Content: Submit in accordance with Section 01 00 00, GENERAL REQUIREMENTS.

- 1) Maintenance and Operation Manuals: Submit as required for systems and equipment specified in the technical sections. Furnish four copies, bound in hardback binders, (manufacturer's standard binders) or an approved equivalent. Furnish one complete manual as specified in the technical section but in no case later than prior to performance of systems or equipment test, and furnish the remaining manuals prior to contract completion.
- 2) Inscribe the following identification on the cover: the words "MAINTENANCE AND OPERATION MANUAL," the name and location of the system, equipment, building, name of Contractor, and contract number. Include in the manual the names, addresses, and telephone numbers of each subcontractor installing the system or equipment and the local representatives for the system or equipment.
- 3) The manuals shall include:
  - a) Internal and interconnecting wiring and control diagrams with data to explain detailed operation and control of the equipment.
  - b) A control sequence describing start-up, operation, and shutdown.
  - c) Description of the function of each principal item of equipment.
  - d) Installation and maintenance instructions.

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- e) Safety precautions.
  - f) Diagrams and illustrations.
  - g) Testing methods.
  - h) Performance data.
  - i) Pictorial "exploded" parts list with part numbers. Emphasis shall be placed on the use of special tools and instruments. The list shall indicate sources of supply, recommended spare parts, and name of servicing organization.
  - j) Appendix; list qualified permanent servicing organizations for support of the equipment, including addresses and certified qualifications.
- g. Binder Organization: Organize each manual into separate sections for each piece of related equipment. At a minimum, each manual shall contain a title page, table of contents, copies of Product Data supplemented by drawings and written text, and copies of each warranty, bond, certifications, and service Contract issued. Refer to Group I through V Technical Data Package Submittal requirements for required section content.
- h. Title Page: Provide a title page as the first sheet of each manual to include the following information; project name and address, subject matter covered by the manual, name and address of the Project, date of the submittal, name, address, and telephone number of the Contractor, and cross references to related systems in other operating and/or maintenance manuals.
- i. Table of Contents: After the title page, include a type written table of contents for each volume, arranged systematically according to the Project Manual format. Provide a list of each product included, identified by product name or other appropriate identifying symbols and indexed to the content of the volume. Where more than one (1) volume is required to hold data for a particular system, provide a comprehensive table of contents for all volumes in each volume of the set.
- j. General Information Section: Provide a general information section immediately following the table of contents, listing each product included in the manual, identified by product name. Under each product, list the name, address, and telephone number of the installer and maintenance Contractor. In addition, list a local source for replacement parts and equipment.
- k. Drawings: Provide specially prepared drawings where necessary to supplement the manufacturers printed data to illustrate the



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relationship between components of equipment or systems, or provide control or flow diagrams. Coordinate these drawings with information contained in Project Record Drawings to assure correct illustration of the completed installation.

- l. Manufacturer's Data: Where manufacturer's standard printed data is included in the manuals, include only those sheets that are pertinent to the part or product installed. Mark each sheet to identify each part or product included in the installation. Where more than one (1) item in tabular format is included, identify each item, using appropriate references from the Contract Documents. Identify data that is applicable to the installation and delete references to information which is not applicable.
  - m. Where manufacturer's standard printed data is not available and the information is necessary for proper operation and maintenance of equipment or systems, or it is necessary to provide additional information to supplement the data included in the manual, prepare written text to provide the necessary information. Organize the text in a consistent format under a separate heading for different procedures. Where necessary, provide a logical sequence of instruction for each operating or maintenance procedure. Where similar or more than one product is listed on the submittal the Contractor shall differentiate by highlighting the specific product to be utilized.
  - n. Calculations: Provide a section for circuit and panel calculations.
  - o. Loading Sheets: Provide a section for DGP Loading Sheets.
  - p. Certifications: Provide section for Contractor's manufacturer certifications.
7. Contractor Review: Review submittals prior to transmittal. Determine and verify field measurements and field construction criteria. Verify manufacturer's catalog numbers and conformance of submittal with requirements of contract documents. Return non-conforming or incomplete submittals with requirements of the work and contract documents. Apply Contractor's stamp with signature certifying the review and verification of products occurred, and the field dimensions, adjacent construction, and coordination of information is in accordance with the requirements of the contract documents.
8. Resubmission: Revise and resubmit submittals as required within 15 calendar days of return of submittal. Make resubmissions under

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- procedures specified for initial submittals. Identify all changes made since previous submittal.
9. Product Data: Within 15 calendar days after execution of the contract, the Contractor shall submit for approval a complete list of all of major products proposed for use. The data shall include name of manufacturer, trade name, model number, the associated contract document section number, paragraph number, and the referenced standards for each listed product.
- F. Group 1 Technical Data Package: Group I Technical Data Package shall be one submittal consisting of the following content and organization. Refer to VA Special Conditions Document for drawing format and content requirements. The data package shall include the following:
1. Section I - Drawings:
    - a. General - Drawings shall conform to VA CAD Standards Guide. All text associated with security details shall be 1/8" tall and meet VA text standard for AutoCAD™ drawings.
    - b. Cover Sheet - Cover sheet shall consist of Project Title and Address, Project Number, Area and Vicinity Maps.
    - c. General Information Sheets - General Information Sheets shall consist of General Notes, Abbreviations, Symbols, Wire and Cable Schedule, Project Phasing, and Sheet Index.
    - d. Floor Plans - Floor plans shall be produced from the Architectural backgrounds issued in the Construction Documents. The contractor shall receive floor plans from the prime A/E to develop these drawing sets. Security devices shall be placed on drawings in scale. All text associated with security details shall be 1/8" tall and meet VA text standard for AutoCAD™ drawings. Floor plans shall identify the following:
      - 1) Security devices by symbol,
      - 2) The associated device point number (derived from the loading sheets),
      - 3) Wire & cable types and counts
      - 4) Conduit sizing and routing
      - 5) Conduit riser systems
      - 6) Device and area detail call outs
    - e. Architectural details - Architectural details shall be produced for each device mounting type (door details for EECS and IDS, Intrusion Detection system (motion sensor, vibration, microwave Motion Sensor and Camera mounting,

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- f. Riser Diagrams - Contractor shall provide a riser diagram indicating riser architecture and distribution of the SMS throughout the facility (or area in scope).
- g. Block Diagrams - Contractor shall provide a block diagram for the entire system architecture and interconnections with SMS subsystems. Block diagram shall identify SMS subsystem (e.g., electronic entry control, intrusion detection, closed circuit television, intercom, and other associated subsystems) integration; and data transmission and media conversion methodologies.
- h. Interconnection Diagrams - Contractor shall provide interconnection diagram for each sensor, and device component. Interconnection diagram shall identify termination locations, standard wire detail to include termination schedule. Diagram shall also identify interfaces to other systems such as elevator control, fire alarm systems, and security management systems.
- i. Security Details:
  - 1) Panel Assembly Detail - For each panel assembly, a panel assembly details shall be provided identifying individual panel component size and content.
  - 2) Panel Details - Provide security panel details identify general arrangement of the security system components, backboard size, wire through size and location, and power circuit requirements.
  - 3) Device Mounting Details - Provide mounting detailed drawing for each security device (physical access control system, intrusion detection, video surveillance and assessment, and intercom systems) for each type of wall and ceiling configuration in project. Device details shall include device, mounting detail, wiring and conduit routing.
  - 4) Details of connections to power supplies and grounding
  - 5) Details of surge protection device installation
  - 6) Sensor detection patterns - Each system sensor shall have associated detection patterns.
  - 7) Equipment Rack Detail - For each equipment rack, provide a scaled detail of the equipment rack location and rack space utilization. Use of BISC wire management standards shall be employed to identify wire management methodology. Transitions between equipment racks shall be shown to include use vertical and horizontal latter rack system.

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- 8) Security Control Room - The contractor shall provide a layout plan for the Security Control Room. The layout plan shall identify all equipment and details associated with the installation.
- 9) Operator Console - The contractor shall provide a layout plan for the Operator Console. The layout plan shall identify all equipment and details associated with the installation.  
Equipment room - the contractor shall provide a layout plan for the equipment room. The layout plan shall identify all equipment and details associated with the installation.
- 10) Equipment Room - Equipment room details shall provide architectural, electrical, mechanical, plumbing, IT/Data and associated equipment and device placements both vertical and horizontally.
- j. Electrical Panel Schedule - Electrical Panel Details shall be provided for all SMS systems electrical power circuits. Panel details shall be provided identifying panel type (Standard, Emergency Power, Emergency/Uninterrupted Power Source, and Uninterrupted Power Source Only), panel location, circuit number, and circuit amperage rating.
- k. Door Schedule - A door schedule shall be developed for each door equipped with electronic security components. At a minimum, the door schedule shall be coordinated with Division 08 work and include the following information:
  - 1) Item Number
  - 2) Door Number (Derived from A/E Drawings)
  - 3) Floor Plan Sheet Number
  - 4) Standard Detail Number
  - 5) Door Description (Derived from Loading Sheets)
  - 6) Data Gathering Panel Input Number
  - 7) Door Position or Monitoring Device Type & Model Number
  - 8) Lock Type, Model Number & Power Input/Draw (standby/active)
  - 9) Card Reader Type & Model Number
  - 10) Shunting Device Type & Model Number
  - 11) Sounder Type & Model Number
  - 12) Manufacturer
  - 13) Misc. devices as required
    - a) Delayed Egress Type & Model Number
    - b) Intercom
    - c) Camera

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- d) Electric Transfer Hinge
- e) Electric Pass-through device
- 14) Remarks column indicating special notes or door configurations
- 2. Camera Schedule - A camera schedule shall be developed for each camera. Contractors shall coordinate with the Resident Engineer to determine camera starting numbers and naming conventions. All drawings shall identify wire and cable standardization methodology. Color coding of all wiring conductors and jackets is required and shall be communicated consistently throughout the drawings package submittal. At a minimum, the camera schedule shall include the following information:
  - a. Item Number
  - b. Camera Number
  - c. Naming Conventions
  - d. Description of Camera Coverage
  - e. Camera Location
  - f. Floor Plan Sheet Number
  - g. Camera Type
  - h. Mounting Type
  - i. Standard Detail Reference
  - j. Power Input & Draw
  - k. Power Panel Location
  - l. Remarks Column for Camera
- 3. Section II - Data Gathering Panel Documentation Package
  - a. Contractor shall provide Data Gathering Panel (DGP) input and output documentation packages for review at the Shop Drawing submittal stage and also with the as-built documentation package. The documentation packages shall be provided in both printed and magnetic form at both review stages.
  - b. The Contractor shall provide loading sheet documentation package for the associated DGP, including input and output boards for all field panels associated with the project. Documentation shall be provided in current version Microsoft Excel spreadsheets following the format currently utilized by VA. A separate spreadsheet file shall be generated for each DGP and associated field panels.
  - c. The spreadsheet names shall follow a sequence that shall display the spreadsheets in numerical order according to the DGP system number. The spreadsheet shall include the prefix in the file name that uniquely identifies the project site. The spreadsheet shall detail all connected items such as card readers, alarm inputs, and

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relay output connections. The spreadsheet shall include an individual section (row) for each panel input, output and card reader. The spreadsheet shall automatically calculate the system numbers for card readers, inputs, and outputs based upon data entered in initialization fields.

- d. All entries must be verified against the field devices. Copies of the floor plans shall be forwarded under separate cover.
- e. The DGP spreadsheet shall include an entry section for the following information:
  - 1) DGP number
  - 2) First Reader Number
  - 3) First Monitor Point Number
  - 4) First Relay Number
  - 5) DGP, input or output Location
  - 6) DGP Chain Number
  - 7) DGP Cabinet Tamper Input Number
  - 8) DGP Power Fail Input Number
  - 9) Number of Monitor Points Reserved For Expansion Boards
  - 10) Number of Control Points (Relays) Reserved For Expansion Boards
- f. The DGP, input module and output module spreadsheets shall automatically calculate the following information based upon the associated entries in the above fields:
  - 1) System Numbers for Card Readers
  - 2) System Numbers for Monitor Point Inputs
  - 3) System Numbers for Control Points (Relays)
  - 4) Next DGP or input module First Monitor Point Number
  - 5) Next DGP or output module First Control Point Number
- g. The DGP spreadsheet shall provide the following information for each card reader:
  - 1) DGP Reader Number
  - 2) System Reader Number
  - 3) Cable ID Number
  - 4) Description Field (Room Number)
  - 5) Description Field (Device Type i.e.: In Reader, Out Reader, etc.)
  - 6) Description Field
  - 7) DGP Input Location
  - 8) Date Test
  - 9) Date Passed
  - 10) Cable Type

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- 11) Camera Numbers (of cameras viewing the reader location)
- h. The DGP and input module spreadsheet shall provide the following information for each monitor point (alarm input).
  - 1) DGP Monitor Point Input Number
  - 2) System Monitor Point Number
  - 3) Cable ID Number
  - 4) Description Field (Room Number)
  - 5) Description Field (Device Type i.e.: Door Contact, Motion Detector, etc.)
  - 7) DGP or input module Input Location
  - 8) Date Test
  - 9) Date Passed
  - 10) Cable Type
  - 11) Camera Numbers (of associated alarm event preset call-ups)
- i. The DGP and output module spreadsheet shall provide the following information for each control point (output relay).
  - 1) DGP Control Point (Relay) Number
  - 2) System (Control Point) Number
  - 3) Cable ID Number
  - 4) Description Field (Room Number)
  - 5) Description Field (Device: Lock Control, Local Sounder, etc.)
  - 6) Description Field
  - 7) DGP or OUTPUT MODULE Output Location
  - 8) Date Test
  - 9) Date Passed Cable Type
  - 10) Camera Number (of associated alarm event preset call-ups)
- j. The DGP, input module and output module spreadsheet shall include the following information or directions in the header and footer:
  - 1) Header
    - a) DGP Input and Output Worksheet
    - b) Enter Beginning Reader, Input, and Output Starting Numbers and Sheet Will Automatically Calculate the Remaining System Numbers.
  - 2) Footer
    - a) File Name
    - b) Date Printed
    - c) Page Number
4. Section III - Construction Mock-up: In areas with exposed EMT/Conduit Raceways, contractor shall conceal raceway as much as practical and unobtrusively. In addition, historic significance must

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be considered to determine installation means and methods for approval by the Resident Engineer.

5. Section IV - Manufacturers' Data: The data package shall include manufacturers' data for all materials and equipment, including sensors, local processors and console equipment provided under this specification.
6. Section V - System Description and Analysis: The data package shall include system descriptions, analysis, and calculations used in sizing equipment required by these specifications. Descriptions and calculations shall show how the equipment will operate as a system to meet the performance requirements of this specification. The data package shall include the following:
  - a. Central processor memory size; communication speed and protocol description; rigid disk system size and configuration; flexible disk system size and configuration; back-up media size and configuration; alarm response time calculations; command response time calculations; start-up operations; expansion capability and method of implementation; sample copy of each report specified; and color photographs representative of typical graphics.
  - b. Software Data: The data package shall consist of descriptions of the operation and capability of the system, and application software as specified.
  - c. Overall System Reliability Calculations: The data package shall include all manufacturers' reliability data and calculations required to show compliance with the specified reliability.
7. Section VI - Certifications & References: All specified manufacturer's certifications shall be included with the data package. Contractor shall provide Project references as outlined in Paragraph 1.4 "Quality Assurance".

**G. Group II Technical Data Package:**

1. The Contractor shall prepare a report of "Current Site Conditions" and submit a report to the Resident Engineer documenting changes to the site, particularly those conditions that affect performance of the system to be installed. The Contractor shall provide specification sheets, or written functional requirements to support the findings, and a cost estimate to correct those site changes or conditions which affect the installation of the system or its performance. The Contractor shall not correct any deficiency without written permission from the COTR.



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2. System Configuration and Functionality: The contractor shall provide the results of the meeting with VA to develop system requirements and functionality including but not limited to:
  - a. Baseline configuration
  - b. Access levels
  - c. Schedules (intrusion detection, physical access control, holidays, etc.)
  - d. Badge database
  - e. System monitoring and reporting (unit level and central control)
  - f. Naming conventions and descriptors

H. Group III Technical Data Package:

1. Development of Test Procedures: The Contractor will prepare performance test procedures for the system testing. The test procedures shall follow the format of the VA Testing procedures and be customized to the contract requirements. The Contractor will deliver the test procedures to the Resident Engineer for approval at least 60 calendar days prior to the requested test date.

I. Group IV Technical Data Package:

1. Performance Verification Test

- a. Based on the successful completion of the pre-delivery test, the Contractor shall finalize the test procedures and report forms for the performance verification test (PVT) and the endurance test. The PVT shall follow the format, layout and content of the pre-delivery test. The Contractor shall deliver the PVT and endurance test procedures to the Resident Engineer for approval. The Contractor may schedule the PVT after receiving written approval of the test procedures. The Contractor shall deliver the final PVT and endurance test reports within 14 calendar days from completion of the tests. Refer to Part 3 of this section for System Testing and Acceptance requirements.

2. Training Documentation:

- a. New Facilities and Major Renovations: Familiarization training shall be provided for new equipment or systems. Training can include site familiarization training for VA technicians and administrative personnel. Training shall include general information on new system layout including closet locations, turnover of the completed system including all documentation, including manuals, software, key systems, and full system administration rights. Lesson plans and training manuals training shall be oriented to type of training to be provided.

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b. New Unit Control Room:

- 1) Provide the security personnel with training in the use, operation, and maintenance of the entire control room system (Unit Control and Equipment Rooms). The training documentation must include the operation and maintenance. The first of the training sessions shall take place prior to system turnover and the second immediately after turnover. Coordinate the training sessions with the Resident Engineer. Completed classroom sessions will be witnessed and documented by the Architect/Engineer, and approved by the Resident Engineer. Instruction is not to begin until the system is operational as designed.
- 2) The training documents will cover the operation and the maintenance manuals and the control console operators' manuals and service manuals in detail, stressing all important operational and service diagnostic information necessary for the maintenance and operations personnel to efficiently use and maintain all systems.
- 3) Provide an illustrated control console operator's manual and service manual. The operator's manual shall be written in laymen's language and printed so as to become a permanent reference document for the operators, describing all control panel switch operations, graphic symbol definitions and all indicating functions and a complete explanation of all software.
- 4) The service manual shall be written in laymen's language and printed so as to become a permanent reference document for maintenance personnel, describing how to run internal self-diagnostic software programs, troubleshoot head end hardware and field devices with a complete scenario simulation of all possible system malfunctions and the appropriate corrective measures.
- 5) Provide a professional color DVD instructional recording of all the operational procedures described in the operator's manual. All charts used in the training session shall be clearly presented on the video. Any DVD found to be inferior in recording or material content shall be reproduced at no cost until an acceptable DVD is submitted. Provide four copies of the training DVD, one to the architect/engineer and three to the Resident Engineer.

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3. System Configuration and Data Entry:
  - a. The contractor is responsible for providing all system configuration and data entry for the SMS and subsystems (e.g., video matrix switch, intercom, digital video recorders, network video recorders). All data entry shall be performed per VA standards & guidelines. The Contractor is responsible for participating in all meetings with the client to compile the information needed for data entry. These meetings shall be established at the beginning of the project and incorporated in to the project schedule as a milestone task. The contractor shall be responsible for all data collection, data entry, and system configuration. The contractor shall collect, enter, & program and/or configure the following components:
    - 1) Physical Access control system components,
    - 2) All intrusion detection system components,
    - 3) Video surveillance, control and recording systems,
    - 4) Intercom systems components,
    - 5) All other security subsystems shown in the contract documents.
  - b. The Contractor is responsible for compiling the card access database for the VA employees, including programming reader configurations, access shifts, schedules, exceptions, card classes and card enrollment databases.
  - c. Refer to Part 3 for system programming requirements and planning guidelines.
4. Graphics: Based on CAD as-built drawings developed for the construction project, create all map sets showing locations of all alarms and field devices. Graphical maps of all alarm points installed under this contract including perimeter and exterior alarm points shall be delivered with the system. The Contractor shall create and install all graphics needed to make the system operational. The Contractor shall utilize data from the contract documents, Contractor's field surveys, and all other pertinent information in the Contractor's possession to complete the graphics. The Contractor shall identify and request from the COTR, any additional data needed to provide a complete graphics package. Graphics shall have sufficient level of detail for the system operator to assess the alarm. The Contractor shall supply hard copy, color examples at least 203.2 x 254 mm (8 x 10 in) of each type of graphic to be used for the completed Security system. The graphics examples shall be delivered to the Resident Engineer for review and

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approval at least 90 calendar days prior to the scheduled date the Contractor requires them.

J. Group V Technical Data Package: Final copies of the manuals shall be delivered to the Resident Engineer as part of the acceptance test. The draft copy used during site testing shall be updated with any changes required prior to final delivery of the manuals. Each manual's contents shall be identified on the cover. The manual shall include names, addresses, and telephone numbers of each sub-contractor installing equipment or systems, as well as the nearest service representatives for each item of equipment for each system. The manuals shall include a table of contents and tab sheets. Tab sheets shall be placed at the beginning of each chapter or section and at the beginning of each appendix. The final copies delivered after completion of the endurance test shall include all modifications made during installation, checkout, and acceptance. Six (6) hard-copies and one (1) soft copy on CD of each item listed below shall be delivered as a part of final systems acceptance.

1. Functional Design Manual: The functional design manual shall identify the operational requirements for the entire system and explain the theory of operation, design philosophy, and specific functions. A description of hardware and software functions, interfaces, and requirements shall be included for all system operating modes. Manufacturer developed literature may be used; however, shall be produced to match the project requirements.
2. Equipment Manual: A manual describing all equipment furnished including:
  - a. General description and specifications; installation and checkout procedures; equipment electrical schematics and layout drawings; system schematics and layout drawings; alignment and calibration procedures; manufacturer's repair list indicating sources of supply; and interface definition.
3. Software Manual: The software manual shall describe the functions of all software and include all other information necessary to enable proper loading, testing, and operation. The manual shall include:
  - a. Definition of terms and functions; use of system and applications software; procedures for system initialization, start-up, and shutdown; alarm reports; reports generation, database format and data entry requirements; directory of all disk files; and description of all communications protocols including data

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formats, command characters, and a sample of each type of data transfer.

4. Operator's Manual: The operator's manual shall fully explain all procedures and instructions for the operation of the system, including:
  - a. Computers and peripherals; system start-up and shutdown procedures; use of system, command, and applications software; recovery and restart procedures; graphic alarm presentation; use of report generator and generation of reports; data entry; operator commands' alarm messages, and printing formats; and system access requirements.
5. Maintenance Manual: The maintenance manual shall include descriptions of maintenance for all equipment including inspection, recommend schedules, periodic preventive maintenance, fault diagnosis, and repair or replacement of defective components.
6. Spare Parts & Components Data: At the conclusion of the Contractor's work, the Contractor shall submit to the Resident Engineer a complete list of the manufacturer's recommended spare parts and components required to satisfactorily maintain and service the systems, as well as unit pricing for those parts and components.
7. Operation, Maintenance & Service Manuals: The Contractor shall provide two (2) complete sets of operating and maintenance manuals in the form of an instructional manual for use by the VA Security Guard Force personnel. The manuals shall be organized into suitable sets of manageable size. Where possible, assemble instructions for similar equipment into a single binder. If multiple volumes are required, each volume shall be fully indexed and coordinated.
8. Equipment and Systems Maintenance Manual: The Contractor shall provide the following descriptive information for each piece of equipment, operating system, and electronic system:
  - a. Equipment and/or system function.
  - b. Operating characteristics.
  - c. Limiting conditions.
  - d. Performance curves.
  - e. Engineering data and test.
  - f. Complete nomenclature and number of replacement parts.
  - g. Provide operating and maintenance instructions including assembly drawings and diagrams required for maintenance and a list of items recommended to stock as spare parts.

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- h. Provide information detailing essential maintenance procedures including the following: routine operations, troubleshooting guide, disassembly, repair and re-assembly, alignment, adjusting, and checking.
  - i. Provide information on equipment and system operating procedures, including the following; start-up procedures, routine and normal operating instructions, regulation and control procedures, instructions on stopping, shut-down and emergency instructions, required sequences for electric and electronic systems, and special operating instructions.
  - j. Manufacturer equipment and systems maintenance manuals are permissible.
- 9. Project Redlines: During construction, the Contractor shall maintain an up-to-date set of construction redlines detailing current location and configuration of the project components. The redline documents shall be marked with the words 'Master Redlines' on the cover sheet and be maintained by the Contractor in the project office. The Contractor will provide access to redline documents anytime during the project for review and inspection by the Resident Engineer or authorized Office of Protection Services representative. Master redlines shall be neatly maintained throughout the project and secured under lock and key in the contractor's onsite project office. Any project component or assembly that is not installed in strict accordance with the drawings shall be so noted on the drawings. Prior to producing Record Construction Documents, the contractor will submit the Master Redline document to the Resident Engineer for review and approval of all changes or modifications to the documents. Each sheet shall have Resident Engineer initials indicating authorization to produce "As Built" documents. Field drawings shall be used for data gathering & field changes. These changes shall be made to the master redline documents daily. Field drawings shall not be considered "master redlines".
- 10. Record Specifications: The Contractor shall maintain one (1) copy of the Project Specifications, including addenda and modifications issued, for Project Record Documents. The Contractor shall mark the Specifications to indicate the actual installation where the installation varies substantially from that indicated in the Contract Specifications and modifications issued. (Note related Project Record Drawing information where applicable). The Contractor shall pay particular attention to substitutions, selection of product

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options, and information on concealed installations that would be difficult to identify or measure and record later. Upon completion of the mark ups, the Contractor shall submit record Specifications to the COTR. As with master relines, Contractor shall maintain record specifications for Resident Engineer review and inspection at any time.

11. Record Product Data: The Contractor shall maintain one (1) copy of each Product Data submittal for Project Record Document purposes. The Data shall be marked to indicate the actual product installed where the installation varies substantially from that indicated in the Product Data submitted. Significant changes in the product delivered to the site and changes in manufacturer's instructions and recommendations for installation shall be included. Particular attention will be given to information on concealed products and installations that cannot be readily identified or recorded later. Note related Change Orders and mark up of Record Construction Documents, where applicable. Upon completion of mark up, submit a complete set of Record Product Data to the COTR.
12. Miscellaneous Records: The Contractor shall maintain one (1) copy of miscellaneous records for Project Record Document purposes. Refer to other Specifications for miscellaneous record-keeping requirements and submittals concerning various construction activities. Before substantial completion, complete miscellaneous records and place in good order, properly identified and bound or filed, ready for use and reference. Categories of requirements resulting in miscellaneous records include a minimum of the following:
  - a. Certificates received instead of labels on bulk products.
  - b. Testing and qualification of tradesmen. ("Contractor's Qualifications")
  - c. Documented qualification of installation firms.
  - d. Load and performance testing.
  - e. Inspections and certifications.
  - f. Final inspection and correction procedures.
  - g. Project schedule
13. Record Construction Documents (Record As-Built)
  - a. Upon project completion, the contractor shall submit the project master redlines to the Resident Engineer prior to development of Record construction documents. The Resident Engineer shall be given a minimum of a thirty (30) day review period to determine the adequacy of the master redlines. If the master redlines are

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found suitable by the Resident Engineer, the Resident Engineer will initial and date each sheet and turn redlines over to the contractor for as built development.

- b. The Contractor shall provide the Resident Engineer a complete set of "as-built" drawings and original master redlined marked "as-built" blue-line in the latest version of AutoCAD drawings unlocked on CD or DVD. The as-built drawing shall include security device number, security closet connection location, data gathering panel number, and input or output number as applicable.

All corrective notations made by the Contractor shall be legible when submitted to the COTR. If, in the opinion of the COTR, any redlined notation is not legible, it shall be returned to the Contractor for re-submission at no extra cost to the VAMC. The Contractor shall organize the Record Drawing sheets into manageable sets bound with durable paper cover sheets with suitable titles, dates, and other identifications printed on the cover. The submitted as built shall be in editable formats and the ownership of the drawings shall be fully relinquished to the VAMC.

- c. Where feasible, the individual or entity that obtained record data, whether the individual or entity is the installer, sub-contractor, or similar entity, is required to prepare the mark up on Record Drawings. Accurately record the information in a comprehensive drawing technique. Record the data when possible after it has been obtained. For concealed installations, record and check the mark up before concealment. At the time of substantial completion, submit the Record Construction Documents to the COTR. The Contractor shall organize into bound and labeled sets for the COTR's continued usage. Provide device, conduit, and cable lengths on the conduit drawings. Exact in-field conduit placement/routings shall be shown. All conduits shall be illustrated in their entire length from termination in security closets; no arrowed conduit runs shall be shown. Pull box and junction box sizes are to be shown if larger than 100mm (4 inch).

**K. FIPS 201 Compliance Certificates**

- 1. Provide Certificates for all software components and device types utilizing credential verification. Provide certificates for:
  - a. Card Readers.
  - b. PIV Middleware.
  - c. Template Matcher.



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- d. Electromagnetically Opaque Sleeve.
- e. Certificate Management:
  - 1) CAK Authentication System.
  - 2) PIV Authentication System.
  - 3) Certificate Validator.
  - 4) Cryptographic Module.
- L. Approvals will be based on complete submission of manuals together with shop drawings.
- M. After approval and prior to installation, furnish the Resident Engineer with one sample of each of the following:
  - 1. A 300 mm (12 inch) length of each type and size of wire and cable along with the tag from the coils of reels from which the samples were taken.
  - 2. Each type of conduit and pathway coupling, bushing and termination fitting.
  - 3. Conduit hangers, clamps and supports.
  - 4. Duct sealing compound.
- N. Completed System Readiness Checklists provided by the Commissioning Agent and completed by the contractor, signed by a qualified technician and dated on the date of completion, in accordance with the requirements of Section 28 08 00 COMMISSIONING OF ELECTRONIC SAFETY AND SECURITY SYSTEMS.

**1.7 APPLICABLE PUBLICATIONS**

- A. The publications listed below (including amendments, addenda, revisions, supplement, and errata) form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.
- B. American National Standards Institute (ANSI)/ International Code Council (ICC):
  - A117.1 .....Standard on Accessible and Usable Buildings and Facilities
- C. American National Standards Institute (ANSI)/ Security Industry Association (SIA):
  - AC-03 .....Access Control: Access Control Guideline Dye Sublimation Printing Practices for PVC Access Control Cards
  - CP-01-00 .....Control Panel Standard-Features for False Alarm Reduction
  - PIR-01-00 .....Passive Infrared Motion Detector Standard - Features for Enhancing False Alarm Immunity

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- TVAC-01 .....CCTV to Access Control Standard - Message Set  
for System Integration
- D. American National Standards Institute (ANSI)/Electronic Industries  
Alliance (EIA):
- 330-09 .....Electrical Performance Standards for CCTV  
Cameras
- 375A-76 .....Electrical Performance Standards for CCTV  
Monitors
- E. American National Standards Institute (ANSI):
- ANSI S3.2-99 .....Method for measuring the Intelligibility of  
Speech over Communications Systems
- F. American Society for Testing and Materials (ASTM)
- B1-07 .....Standard Specification for Hard-Drawn Copper  
Wire
- B3-07 .....Standard Specification for Soft or Annealed  
Copper Wire
- B8-04 .....Standard Specification for Concentric-Lay-  
Stranded Copper Conductors, Hard, Medium-Hard,  
or Soft
- C1238-97 (R03) .....Standard Guide for Installation of Walk-Through  
Metal Detectors
- D2301-04 .....Standard Specification for Vinyl Chloride  
Plastic Pressure Sensitive Electrical Insulating  
Tape
- G. Architectural Barriers Act (ABA), 1968
- H. Department of Justice: American Disability Act (ADA)
- 28 CFR Part 36-2010 ADA Standards for Accessible Design
- I. Department of Veterans Affairs:
- VHA National CAD Standard Application Guide, 2006
- VA BIM Guide, V1.0 10
- J. Federal Communications Commission (FCC):
- (47 CFR 15) Part 15 Limitations on the Use of Wireless  
Equipment/Systems
- K. Federal Information Processing Standards (FIPS):
- FIPS-201-1 .....Personal Identity Verification (PIV) of Federal  
Employees and Contractors
- L. Federal Specifications (Fed. Spec.):
- A-A-59544-08 .....Cable and Wire, Electrical (Power, Fixed  
Installation)
- M. Government Accountability Office (GAO):

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- GAO-03-8-02 .....Security Responsibilities for Federally Owned  
and Leased Facilities
- N. Homeland Security Presidential Directive (HSPD):
  - HSPD-12 .....Policy for a Common Identification Standard for  
Federal Employees and Contractors
- O. Institute of Electrical and Electronics Engineers (IEEE):
  - 81-1983 .....IEEE Guide for Measuring Earth Resistivity,  
Ground Impedance, and Earth Surface Potentials  
of a Ground System
  - 802.3af-08 .....Power over Ethernet Standard
  - 802.3at-09 .....Power over Ethernet (PoE) Plus Standard
  - C2-07 .....National Electrical Safety Code
  - C62.41-02 .....IEEE Recommended Practice on Surge Voltages in  
Low-Voltage AC Power Circuits
  - C95.1-05 .....Standards for Safety Levels with Respect to  
Human Exposure in Radio Frequency  
Electromagnetic Fields
- P. International Organization for Standardization (ISO):
  - 7810 .....Identification cards - Physical characteristics
  - 7811 .....Physical Characteristics for Magnetic Stripe  
Cards
  - 7816-1 .....Identification cards - Integrated circuit(s)  
cards with contacts - Part 1: Physical  
characteristics
  - 7816-2 .....Identification cards - Integrated circuit cards  
- Part 2: Cards with contacts -Dimensions and  
location of the contacts
  - 7816-3 .....Identification cards - Integrated circuit cards  
- Part 3: Cards with contacts - Electrical  
interface and transmission protocols
  - 7816-4 .....Identification cards - Integrated circuit cards  
- Part 11: Personal verification through  
biometric methods
  - 7816-10 .....Identification cards - Integrated circuit cards  
- Part 4: Organization, security and commands  
for interchange
  - 14443 .....Identification cards - Contactless integrated  
circuit cards; Contactless Proximity Cards  
Operating at 13.56 MHz in up to 5 inches  
distance

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- 15693 .....Identification cards -- Contactless integrated  
circuit cards - Vicinity cards; Contactless  
Vicinity Cards Operating at 13.56 MHz in up to  
50 inches distance
- 19794 .....Information technology - Biometric data  
interchange formats
- Q. National Electrical Contractors Association
  - 303-2005 .....Installing Closed Circuit Television (CCTV)  
Systems
- R. National Electrical Manufacturers Association (NEMA):
  - 250-08 .....Enclosures for Electrical Equipment (1000 Volts  
Maximum)
  - TC-3-04 .....PVC Fittings for Use with Rigid PVC Conduit and  
Tubing
  - FB1-07 .....Fittings, Cast Metal Boxes and Conduit Bodies  
for Conduit, Electrical Metallic Tubing and  
Cable
- S. National Fire Protection Association (NFPA):
  - 70-11 ..... National Electrical Code (NEC)
  - 731-08 .....Standards for the Installation of Electric  
Premises Security Systems
  - 99-2005 .....Health Care Facilities
- T. National Institute of Justice (NIJ)
  - 0601.02-03 .....Standards for Walk-Through Metal Detectors for  
use in Weapons Detection
  - 0602.02-03 .....Hand-Held Metal Detectors for Use in Concealed  
Weapon and Contraband Detection
- U. National Institute of Standards and Technology (NIST):
  - IR 6887 V2.1 .....Government Smart Card Interoperability  
Specification (GSC-IS)
  - Special Pub 800-37 .....Guide for Applying the Risk Management Framework  
to Federal Information Systems
  - Special Pub 800-63 .....Electronic Authentication Guideline
  - Special Pub 800-73-3 ...Interfaces for Personal Identity Verification (4  
Parts)
    - .....Pt. 1- End Point PIV Card Application Namespace,  
Data Model & Representation
    - .....Pt. 2- PIV Card Application Card Command  
Interface

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- .....Pt. 3- PIV Client Application Programming Interface
- .....Pt. 4- The PIV Transitional Interfaces & Data Model Specification
- Special Pub 800-76-1 ...Biometric Data Specification for Personal Identity Verification
- Special Pub 800-78-2 ...Cryptographic Algorithms and Key Sizes for Personal Identity Verification
- Special Pub 800-79-1 ...Guidelines for the Accreditation of Personal Identity Verification Card Issuers
- Special Pub 800-85B-1 ..DRAFTPIV Data Model Test Guidelines
- Special Pub 800-85A-2 ..PIV Card Application and Middleware Interface Test Guidelines (SP 800-73-3 compliance)
- Special Pub 800-96 .....PIV Card Reader Interoperability Guidelines
- Special Pub 800-104A ...Scheme for PIV Visual Card Topography
- V. Occupational and Safety Health Administration (OSHA):
  - 29 CFR 1910.97 .....Nonionizing radiation
- W. Section 508 of the Rehabilitation Act of 1973
- X. Security Industry Association (SIA):
  - AG-01 .....Security CAD Symbols Standards
- Y. Underwriters Laboratories, Inc. (UL):
  - 1-05 .....Flexible Metal Conduit
  - 5-04 .....Surface Metal Raceway and Fittings
  - 6-07 .....Rigid Metal Conduit
  - 44-05 .....Thermoset-Insulated Wires and Cables
  - 50-07 .....Enclosures for Electrical Equipment
  - 83-08 .....Thermoplastic-Insulated Wires and Cables
  - 294-99 .....The Standard of Safety for Access Control System Units
  - 305-08 .....Standard for Panic Hardware
  - 360-09 .....Liquid-Tight Flexible Steel Conduit
  - 444-08 .....Safety Communications Cables
  - 464-09 .....Audible Signal Appliances
  - 467-07 .....Electrical Grounding and Bonding Equipment
  - 486A-03 .....Wire Connectors and Soldering Lugs for Use with Copper Conductors
  - 486C-04 .....Splicing Wire Connectors
  - 486D-05 .....Insulated Wire Connector Systems for Underground Use or in Damp or Wet Locations

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486E-00 .....Equipment Wiring Terminals for Use with Aluminum  
and/or Copper Conductors

493-07 .....Thermoplastic-Insulated Underground Feeder and  
Branch Circuit Cable

514A-04 .....Metallic Outlet Boxes

514B-04 .....Fittings for Cable and Conduit

51-05 .....Schedule 40 and 80 Rigid PVC Conduit

609-96 .....Local Burglar Alarm Units and Systems

634-07 .....Standards for Connectors with Burglar-Alarm  
Systems

636-01 .....Standard for Holdup Alarm Units and Systems

639-97 .....Standard for Intrusion-Detection Units

651-05 .....Schedule 40 and 80 Rigid PVC Conduit

651A-07 .....Type EB and A Rigid PVC Conduit and HDPE Conduit

752-05 .....Standard for Bullet-Resisting Equipment

797-07 .....Electrical Metallic Tubing

827-08 .....Central Station Alarm Services

1037-09 .....Standard for Anti-theft Alarms and Devices

1635-10 .....Digital Alarm Communicator System Units

1076-95 .....Standards for Proprietary Burglar Alarm Units  
and Systems

1242-06 .....Intermediate Metal Conduit

1479-03 .....Fire Tests of Through-Penetration Fire Stops

1981-03 .....Central Station Automation System

2058-05 .....High Security Electronic Locks

60950 .....Safety of Information Technology Equipment

60950-1 .....Information Technology Equipment - Safety - Part  
1: General Requirements

Z. Uniform Federal Accessibility Standards (UFAS) 1984

AA. United States Department of Commerce:

Special Pub 500-101 ...Care and Handling of Computer Magnetic Storage  
Media

**1.8 COORDINATION**

A. Coordinate arrangement, mounting, and support of electronic safety and  
security equipment:

1. To allow maximum possible headroom unless specific mounting heights  
that reduce headroom are indicated.
2. To provide for ease of disconnecting the equipment with minimum  
interference to other installations.

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3. To allow right of way for piping and conduit installed at required slope.
  4. So connecting raceways, cables, wireways, cable trays, and busways will be clear of obstructions and of the working and access space of other equipment.
- B. Coordinate installation of required supporting devices and set sleeves in cast-in-place concrete, masonry walls, and other structural components as they are constructed.
- C. Coordinate location of access panels and doors for electronic safety and security items that are behind finished surfaces or otherwise concealed.

**1.9 MAINTENANCE & SERVICE**

A. General Requirements:

1. The Contractor shall provide all services required and equipment necessary to maintain the entire integrated electronic security system in an operational state as specified for a period of one (1) year after formal written acceptance of the system. The Contractor shall provide all necessary material required for performing scheduled adjustments or other non-scheduled work. Impacts on facility operations shall be minimized when performing scheduled adjustments or other non-scheduled work. See also General Project Requirements.

B. Description of Work:

1. The adjustment and repair of the security system includes all software updates, panel firmware, and the following new items computers equipment, communications transmission equipment and data transmission media (DTM), local processors, security system sensors, physical access control equipment, facility interface, signal transmission equipment, and video equipment.

C. Personnel:

1. Service personnel shall be certified in the maintenance and repair of the selected type of equipment and qualified to accomplish all work promptly and satisfactorily. The Resident Engineer shall be advised in writing of the name of the designated service representative, and of any change in personnel. The Resident Engineer shall be provided copies of system manufacturer certification for the designated service representative.

D. Schedule of Work:

1. The work shall be performed during regular working hours, Monday through Friday, excluding federal holidays.

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**E. System Inspections:**

**1. These inspections shall include:**

- a. The Contractor shall perform two (2) minor inspections at six (6) month intervals or more if required by the manufacturer, and two (2) major inspections offset equally between the minor inspections to effect quarterly inspection of alternating magnitude.
  - 1) Minor Inspections shall include visual checks and operational tests of all console equipment, peripheral equipment, local processors, sensors, electrical and mechanical controls, and adjustments on printers.
  - 2) Major Inspections shall include all work described for Minor Inspections and the following: clean all system equipment and local processors including interior and exterior surfaces; perform diagnostics on all equipment; operational tests of the CPU, switcher, peripheral equipment, recording devices, monitors, picture quality from each camera; check, walk test, and calibrate each sensor; run all system software diagnostics and correct all problems; and resolve any previous outstanding problems.

**F. Emergency Service:**

1. The Resident Engineer shall initiate service calls whenever the system is not functioning properly. The Contractor shall provide the Resident Engineer with an emergency service center telephone number. The emergency service center shall be staffed 24 hours a day 365 days a year. The Resident Engineer shall have sole authority for determining catastrophic and non-catastrophic system failures within parameters stated in General Project Requirements.
  - a. For catastrophic system failures, the Contractor shall provide same day four (4) hour service response with a defect correction time not to exceed eight (8) hours from [notification] [arrival on site]. Catastrophic system failures are defined as any system failure that the Resident Engineer determines will place the facility(s) at increased risk.
  - b. For non-catastrophic failures, the Contractor within eight (8) hours with a defect correction time not to exceed 24 hours from notification.

**G. Operation:**

1. Performance of scheduled adjustments and repair shall verify operation of the system as demonstrated by the applicable portions of the performance verification test.



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**H. Records & Logs:**

1. The Contractor shall maintain records and logs of each task and organize cumulative records for each component and for the complete system chronologically. A continuous log shall be submitted for all devices. The log shall contain all initial settings, calibration, repair, and programming data. Complete logs shall be maintained and available for inspection on site, demonstrating planned and systematic adjustments and repairs have been accomplished for the system.

**I. Work Request:**

1. The Contractor shall separately record each service call request, as received. The record shall include the serial number identifying the component involved, its location, date and time the call was received, specific nature of trouble, names of service personnel assigned to the task, instructions describing the action taken, the amount and nature of the materials used, and the date and time of commencement and completion. The Contractor shall deliver a record of the work performed within five (5) working days after the work was completed.

**J. System Modifications:**

1. The Contractor shall make any recommendations for system modification in writing to the Resident Engineer. No system modifications, including operating parameters and control settings, shall be made without prior written approval from the Resident Engineer. Any modifications made to the system shall be incorporated into the operation and maintenance manuals and other documentation affected.

**K. Software:**

1. The Contractor shall provide all software updates when approved by the Resident Engineer from the manufacturer during the installation and 12-month warranty period and verify operation of the system. These updates shall be accomplished in a timely manner, fully coordinated with the system operators, and incorporated into the operations and maintenance manuals and software documentation. There shall be at least one (1) scheduled update near the end of the first year's warranty period, at which time the Contractor shall install and validate the latest released version of the Manufacturer's software. All software changes shall be recorded in a log maintained in the unit control room. An electronic copy of the software update shall be maintained within the log. At a minimum, the contractor shall provide a description of the modification, when the

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modification occurred, and name and contact information of the individual performing the modification. The log shall be maintained in a white 3 ring binder and the cover marked "SOFTWARE CHANGE LOG".

**1.10 MINIMUM REQUIREMENTS**

- A. References to industry and trade association standards and codes are minimum installation requirement standards.
- B. Drawings and other specification sections shall govern in those instances where requirements are greater than those specified in the above standards.

**1.11 DELIVERY, STORAGE, & HANDLING**

- A. Equipment and materials shall be protected during shipment and storage against physical damage, dirt, moisture, cold and rain:
  - 1. During installation, enclosures, equipment, controls, controllers, circuit protective devices, and other like items, shall be protected against entry of foreign matter; and be vacuum cleaned both inside and outside before testing and operating and repainting if required.
  - 2. Damaged equipment shall be, as determined by the Resident Engineer, placed in first class operating condition or be returned to the source of supply for repair or replacement.
  - 3. Painted surfaces shall be protected with factory installed removable heavy craft paper, sheet vinyl or equal.
  - 4. Damaged paint on equipment and materials shall be refinished with the same quality of paint and workmanship as used by the manufacturer so repaired areas are not obvious.
- B. Central Station, Workstations, and Controllers:
  - 1. Store in temperature and humidity controlled environment in original manufacturer's sealed containers. Maintain ambient temperature between 10 to 30 deg C (50 to 85 deg F), and not more than 80 percent relative humidity, non-condensing.
  - 2. Open each container; verify contents against packing list, and file copy of packing list, complete with container identification for inclusion in operation and maintenance data.
  - 3. Mark packing list with designations which have been assigned to materials and equipment for recording in the system labeling schedules generated by cable and asset management system.
  - 4. Save original manufacturer's containers and packing materials and deliver as directed under provisions covering extra materials.

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**1.12 PROJECT CONDITIONS**

- A. Environmental Conditions: System shall be capable of withstanding the following environmental conditions without mechanical or electrical damage or degradation of operating capability:
1. Interior, Controlled Environment: System components, except central-station control unit, installed in temperature-controlled interior environments shall be rated for continuous operation in ambient conditions of 2 to 50 deg C (36 to 122 deg F) dry bulb and 20 to 90 percent relative humidity, non-condensing. NEMA 250, Type 1 enclosure.
  2. Interior, Uncontrolled Environment: System components installed in non-temperature-controlled interior environments shall be rated for continuous operation in ambient conditions of -18 to 50 deg C (0 to 122 deg F) dry bulb and 20 to 90 percent relative humidity, non-condensing. NEMA 250, Type 4X enclosures.
  3. Exterior Environment: System components installed in locations exposed to weather shall be rated for continuous operation in ambient conditions of -34 to 50 deg C (-30 to 122 deg F) dry bulb and 20 to 90 percent relative humidity, condensing. Rate for continuous operation where exposed to rain as specified in NEMA 250, winds up to 137 km/h (85 mph) and snow cover up to 610 mm (24 in) thick. NEMA 250, Type 4X enclosures.
  4. Hazardous Environment: System components located in areas where fire or explosion hazards may exist because of flammable gases or vapors, flammable liquids, combustible dust, or ignitable fibers shall be rated, listed, and installed according to NFPA 70.
  5. Corrosive Environment: For system components subjected to corrosive fumes, vapors, and wind-driven salt spray in coastal zones, provide NEMA 250, Type 4X enclosures.
- B. Security Environment: Use vandal resistant enclosures in high-risk areas where equipment may be subject to damage.
- C. Console: All console equipment shall, unless noted otherwise, be rated for continuous operation under ambient environmental conditions of 15.6 to 29.4 deg C (60 to 85 deg F) and a relative humidity of 20 to 80 percent.

**1.13 EQUIPMENT AND MATERIALS**

- A. Materials and equipment furnished shall be of current production by manufacturers regularly engaged in the manufacture of such items, for which replacement parts shall be available.

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- B. When more than one unit of the same class of equipment is required, such units shall be the product of a single manufacturer.
- C. Equipment Assemblies and Components:
  - 1. Components of an assembled unit need not be products of the same manufacturer.
  - 2. Manufacturers of equipment assemblies, which include components made by others, shall assume complete responsibility for the final assembled unit.
  - 3. Components shall be compatible with each other and with the total assembly for the intended service.
  - 4. Constituent parts which are similar shall be the product of a single manufacturer.
- D. Factory wiring shall be identified on the equipment being furnished and on all wiring diagrams.
- E. When Factory Testing Is Specified:
  - 1. The Government shall have the option of witnessing factory tests. The contractor shall notify the VA through the Resident Engineer a minimum of 15 working days prior to the manufacturers making the factory tests.
  - 2. Four copies of certified test reports containing all test data shall be furnished to the Resident Engineer prior to final inspection and not more than 90 days after completion of the tests.
  - 3. When equipment fails to meet factory test and re-inspection is required, the contractor shall be liable for all additional expenses, including expenses of the Government.

**1.14 ELECTRICAL POWER**

- A. Electrical power of 120 Volts Alternating Current (VAC) shall be indicated on the Division 26 drawings. Additional locations requiring primary power required by the security system shall be shown as part of these contract documents. Primary power for the security system shall be configured to switch to emergency backup sources automatically if interrupted without degradation of any critical system function. Alarms shall not be generated as a result of power switching, however, an indication of power switching on (on-line source) shall be provided to the alarm monitor. The Security Contractor shall provide an interface (dry contact closure) between the PACS and the Uninterruptible Power Supply (UPS) system so the UPS trouble signals and main power fail appear on the PACS operator terminal as alarms.
- B. Failure of any on-line battery shall be detected and reported as a fault condition. Battery backed-up power supplies shall be provided sized for

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8 hours of operation at actual connected load. Requirements for additional power or locations shall be included with the contract to support equipment and systems offered. The following minimum requirements shall be provided for power sources and equipment.

1. Emergency Generator:

- a. Report Printers: Unit Control Room.
- b. Video Monitors: Unit Control Room.
- d. Lights: Unit Control Room, Equipment Rooms, & Security Offices
- e. Outlets: Security Outlets dedicated to security equipment racks or security enclosure assemblies.
- f. Security Device Power Supplies (DGP, VASS, Card Access, Lock Power, etc.) powered from the security closets or remotely: various locations.
- g. VASS Camera Power Supplies: Security Closets.
- h. VASS Pan/Tilt Units: Various Locations.

2. Uninterruptible Power Supply (UPS) on Emergency Power:

- a. The following 120VAC circuits shall be provided by others. The Security Contractor shall coordinate exact locations with the Electrical Contractor:
  - 1) Security System Monitors and Keyboards: Control Room
  - 2) CPU: Control Equipment Room
  - 3) Communications equipment: Control Equipment Room and various sites.
  - 4) VASS Matrix Switcher: Control Equipment Room
  - 5) VASS: Control Equipment Room
  - 6) Digital Video Recorders, encoders & decoders: Control Room
  - 7) All equipment Room racked equipment.
  - 8) Network switches

**1.15 TRANSIENT VOLTAGE SUPPRESSION, POWER SURGE SUPPLESION, & GROUNDING**

- A. Transient Voltage Surge Suppression: All cables and conductors extending beyond building façade, except fiber optic cables, which serve as communication, control, or signal lines shall be protected against Transient Voltage surges and have Transient Voltage Surge Suppression (TVSS) protection. The TVSS device shall be UL listed in accordance with Standard TIA 497B installed at each end. Lighting and surge suppression shall be a multi-strike variety and include a fault indicator. Protection shall be furnished at the equipment and additional triple solid state surge protectors rated for the application on each wire line circuit shall be installed within 914.4 mm (3 ft) of the building cable entrance. Fuses shall not be used for surge

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protection. The inputs and outputs shall be tested in both normal mode and common mode to verify there is no interference.

1. A 10-microsecond rise time by 1000 microsecond pulse width waveform with a peak voltage of 1500 volts and a peak current of 60 amperes.
2. An 8-microsecond rise time by 20-microsecond pulse width waveform with a peak voltage of 1000 volts and a peak current of 500 amperes.
3. Maximum series current: 2 AMPS. Provide units manufactured by Advanced Protection Technologies, model # TE/FA 10B or TE/FA 20B.
4. Operating Temperature and Humidity: -40 to 85 deg C (-40 to 185 deg F), 0 to 95 percent relative humidity.

**B. Grounding and Surge Suppression**

1. The Security Contractor shall provide grounding and surge suppression to stabilize the voltage under normal operating conditions. To ensure the operation of over current devices, such as fuses, circuit breakers, and relays, underground-fault conditions.
2. Security Contractor shall engineer and provide proper grounding and surge suppression as required by local jurisdiction and prevailing codes and standards referenced in this document.
3. Principal grounding components and features. Include main grounding buses and grounding and bonding connections to service equipment.
4. Details of interconnection with other grounding systems. The lightning protection system shall be provided by the Security Contractor.
5. Locations and sizes of grounding conductors and grounding buses in electrical, data, and communication equipment rooms and closets.
6. AC power receptacles are not to be used as a ground reference point.
7. Any cable that is shielded shall require a ground in accordance with the best practices of the trade and manufactures installation instructions.
8. Protection should be provided at both ends of cabling.

**1.16 COMPONENT ENCLOSURES**

**A. Construction of Enclosures:**

1. Consoles, power supply enclosures, detector control and terminal cabinets, control units, wiring gutters, and other component housings, collectively referred to as enclosures, shall be so formed and assembled as to be sturdy and rigid.
2. Thickness of metal in-cast and sheet metal enclosures of all types shall not be less than those in Tables I and II, UL 611. Sheet steel used in fabrication of enclosures shall be not less than 14 gauge. Consoles shall be 16-gauge.

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3. Doors and covers shall be flanged. Enclosures shall not have pre-punched knockouts. Where doors are mounted on hinges with exposed pins, the hinges shall be of the tight pin type or the ends of hinge pins shall be tack welded to prevent removal. Doors having a latch edge length of less than 609.6 mm (24 in) shall be provided with a single construction core. Where the latch edge of a hinged door is more than 609.6 mm (24 in) or more in length, the door shall be provided with a three-point latching device with construction core; or alternatively with two, one located near each end.
  4. Any ventilator openings in enclosures and cabinets shall conform to the requirements of UL 611. Unless otherwise indicated, sheet metal enclosures shall be designed for wall mounting with tip holes slotted. Mounting holes shall be in positions that remain accessible when all major operating components are in place and the door is open, but shall be in accessible when the door is closed.
  5. Covers of pull and junction boxes provided to facilitate initial installation of the system shall be held in place by tamper proof Torx Center post security screws. Stenciled or painted labels shall be affixed to such boxes indicating they contain no connections. These labels shall not indicate the box is part of the Electronic Security System (ESS).
- B. Consoles & Equipment Racks: All consoles and vertical equipment racks shall include a forced air-cooling system to be provided by others.
1. Vertical Equipment Racks:
    - a. The forced air blowers shall be installed in the vented top of each cabinet and shall not reduce usable rack space.
    - b. The forced air fan shall consist of one fan rated at 105 CFM per rack bay and noise level shall not exceed 55 decibels.
    - c. Vertical equipment racks are to be provided with full sized clear plastic locking doors and vented top panels as shown on contract drawings.
  2. Console racks:
    - a. Forced air fans shall be installed in the top rear of each console bay. The forced air fan shall consist of one fan rated at 105 CFM mounted to a 133mm vented blank panel the noise level of each fan shall not exceed 55 decibels. The fans shall be installed so air is pulled from the bottom of the rack or cabinet and exhausted out the top.
    - b. Console racks are to be provided with flush mounted hinged rear doors with recessed locking latch on the bottom and middle

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sections of the consoles. Provide code access to support wiring for devices located on the work surfaces.

**C. Tamper Provisions and Tamper Switches:**

1. Enclosures, cabinets, housings, boxes and fittings or every product description having hinged doors or removable covers and which contain circuits, or the integrated security system and its power supplies shall be provided with cover operated, corrosion-resistant tamper switches.
2. Tamper switches shall be arranged to initiate an alarm signal that will report to the monitoring station when the door or cover is moved. Tamper switches shall be mechanically mounted to maximize the defeat time when enclosure covers are opened or removed. It shall take longer than 1 second to depress or defeat the tamper switch after opening or removing the cover. The enclosure and tamper switch shall function together in such a manner as to prohibit direct line of sight to any internal component before the switch activates.
3. Tamper switches shall be inaccessible until the switch is activated. Have mounting hardware concealed so the location of the switch cannot be observed from the exterior of the enclosure. Be connected to circuits which are under electrical supervision at all times, irrespective of the protection mode in which the circuit is operating. Be spring-loaded and held in the closed position by the door or cover and be wired so they break the circuit when the door cover is disturbed. Tamper circuits shall be adjustable type screw sets and shall be adjusted by the contractor to eliminate nuisance alarms associated with incorrectly mounted tamper device shall annunciate prior to the enclosure door opening (within 1/4 " tolerance. The tamper device or its components shall not be visible or accessible with common tools to bypass when the enclosure is in the secured mode.
4. The single gang junction boxes for the portrait alarming and pull boxes with less than 102 square mm will not require tamper switches.
5. All enclosures over 305 square mm shall be hinged with an enclosure lock.
6. Control Enclosures: Maintenance/Safety switches on control enclosures, which must be opened to make routing maintenance adjustments to the system and to service the power supplies, shall be push/pull-set automatic reset type.
7. Provide one (1) enclosure tamper switch for each 609 linear mm of enclosure lock side opening evenly spaced.



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8. All security screws shall be Torx-Post Security Screws.
9. The contractor shall provide the Resident Engineer with two (2) torx-post screwdrivers.

**1.17 ELECTRONIC COMPONENTS**

- A. All electronic components of the system shall be of the solid-state type, mounted on printed circuit boards conforming to UL 796. Boards shall be plug-in, quick-disconnect type. Circuitry shall not be so densely placed as to impede maintenance. All power-dissipating components shall incorporate safety margins of not less than 25 percent with respect to dissipation ratings, maximum voltages, and current-carrying capacity.

**1.18 SUBSTITUTE MATERIALS & EQUIPMENT**

- A. Where variations from the contract requirements are requested in accordance with the GENERAL CONDITIONS and Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES, the connecting work and related components shall include, but not be limited to additions or changes to branch circuits, circuit protective devices, conduits, wire, feeders, controls, panels and installation methods.
- B. In addition to this Section the Security Contractor shall also reference Section II, Products and associated divisions. The Resident Engineer shall have final authority on the authorization or refusal of substitutions. If there are no proposed substitutions, a statement in writing from the Contractor shall be submitted to the Resident Engineer stating same. In the preparation of a list of substitutions, the following information shall be included, as a minimum:
  1. Identity of the material or devices specified for which there is a proposed substitution.
  2. Description of the segment of the specification where the material or devices are referenced.
  3. Identity of the proposed substitute by manufacturer, brand name, catalog or model number and the manufacturer's product name.
  4. A technical statement of all operational characteristic expressing equivalence to items to be substituted and comparison, feature-by-feature, between specification requirements and the material or devices called for in the specification; and Price differential.
- C. Materials Not Listed: Furnish all necessary hardware, software, programming materials, and supporting equipment required to place the specified major subsystems in full operation. Note that some supporting equipment, materials, and hardware may not be described herein. Depending on the manufacturers selected by the COTR, some equipment,

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materials and hardware may not be contained in either the Contract Documents or these written specifications, but are required by the manufacturer for complete operation according to the intent of the design and these specifications. In such cases, the Resident Engineer shall be given the opportunity to approve the additional equipment, hardware and materials that shall be fully identified in the bid and in the equipment list submittal. The Resident Engineer shall be consulted in the event there is any question about which supporting equipment, materials, or hardware is intended to be included.

- D. Response to Specification: The Contractor shall submit a point-by-point statement of compliance with each paragraph of the security specification. The statement of compliance shall list each paragraph by number and indicate "COMPLY" opposite the number for each paragraph where the Contractor fully complies with the specification. Where the proposed system cannot meet the requirements of the paragraph, and does not offer an equivalent solution, the offers shall indicate "DOES NOT COMPLY" opposite the paragraph number. Where the proposed system does not comply with the paragraph as written, but the bidder feels it will accomplish the intent of the paragraph in a manner different from that described, the offers shall indicate "COMPARABLE". The offers shall include a statement fully describing the "comparable" method of satisfying the requirement. Where a full and concise description is not provided, the offered system shall be considered as not complying with the specification. Any submission that does not include a point-by-point statement of compliance, as described above, shall be disqualified. Submittals for products shall be in precise order with the product section of the specification. Submittals not in proper sequence will be rejected.

**1.19 LIKE ITEMS**

- A. Where two or more items of equipment performing the same function are required, they shall be exact duplicates produced by one manufacturer. All equipment provided shall be complete, new, and free of any defects.

**1.20 WARRANTY**

- A. The Contractor shall, as a condition precedent to the final payment, execute a written guarantee (warranty) to the COTR certifying all contract requirements have been completed according to the final specifications. Contract drawings and the warranty of all materials and equipment furnished under this contract are to remain in satisfactory operating condition (ordinary wear and tear, abuse and causes beyond his control for this work accepted) for one (1) year from the date the

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Contactor received written notification of final acceptance from the COTR. Demonstration and training shall be performed prior to system acceptance. All defects or damages due to faulty materials or workmanship shall be repaired or replaced without delay, to the COTR's satisfaction, and at the Contractor's expense. The Contractor shall provide quarterly inspections during the warranty period. The contractor shall provide written documentation to the COTR on conditions and findings of the system and device(s). In addition, the contractor shall provide written documentation of test results and stating what was done to correct any deficiencies. The first inspection shall occur 90 calendar days after the acceptance date. The last inspection shall occur 30 calendar days prior to the end of the warranty. The warranty period shall be extended until the last inspection and associated corrective actions are complete. When equipment and labor covered by the Contractor's warranty, or by a manufacturer's warranty, have been replaced or restored because of it's failure during the warranty period, the warranty period for the replaced or repaired equipment or restored work shall be reinstated for a period equal to the original warranty period, and commencing with the date of completion of the replacement or restoration work. In the event any manufacturer customarily provides a warranty period greater than one (1) year, the Contractor's warranty shall be for the same duration for that component.

**1.21 SINGULAR NUMBER**

Where any device or part of equipment is referred to in these specifications in the singular number (e.g., "the switch"), this reference shall be deemed to apply to as many such devices as are required to complete the installation as shown on the drawings.

**PART 2 - PRODUCTS**

**2.1 EQUIPMENT AND MATERIALS**

- A. All equipment associated within the Security Control Room, Security Console and Security Equipment Room shall be UL 827, UL 1981, and UL 60950 compliant and rated for continuous operation. Environmental conditions (i.e. temperature, humidity, wind, and seismic activity) shall be taken under consideration at each facility and site location prior to installation of the equipment.
- B. All equipment shall operate on a 120 or 240 volts alternating current (VAC); 50 Hz or 60 Hz AC power system unless documented otherwise in subsequent sections listed within this specification. All equipment shall have a back-up source of power that will provide a minimum of [8]

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<insert hours> hours of run time in the event of a loss of primary power to the facility.

- C. The system shall be designed, installed, and programmed in a manner that will allow for ease of operation, programming, servicing, maintenance, testing, and upgrading of the system.
- D. All equipment and materials for the system will be compatible to ensure correct operation.

**2.2 EQUIPMENT ITEMS**

- A. The Security Management System shall provide full interface with all components of the security subsystem as follows:
  - 1. Shall allow for communication between the Physical Access Control System and Database Management and all subordinate work and monitoring stations, enrollment centers for badging and biometric devices as part of the PACS, local annunciation centers, the electronic Security Management System (SMS), and all other VA redundant or backup command center or other workstations locations.
  - 2. Shall provide automatic continuous communication with all systems that are monitored by the SMS, and shall automatically annunciate any communication failures or system alarms to the SMS operator providing identification of the system, nature of the alarm, and location of the alarm.
  - 3. Controlling devices shall be utilized to interface the SMS with all field devices.
  - 4. The Security control room and security console will be supported by an uninterrupted power supply (UPS) or dedicated backup generator power circuit.
  - 5. The Security Equipment room, Security Control Room, and Security Operator Console shall house the following equipment i.e. refer to individual master specifications for each security subsystem's specific requirements:
    - a. Security Console Bays and Equipment Racks
    - b. Security Network Server and Workstation
    - c. CCTV Monitoring, Controlling, and Recording Equipment
    - d. PACS Monitoring and Controlling Equipment
    - e. IDS Monitoring and Controlling Equipment
    - f. Security Access Detection Monitoring Equipment
    - g. EPPS Monitoring and Controlling Equipment
    - h. Main Panels for all Security Systems
    - i. Power Supply Units (PSU) for all field devices
    - j. Life safety and power monitoring equipment

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- k. All other building systems deemed necessary by the VA to include, but not limited to, heating, ventilation and air conditioning (HVAC), elevator control, portable radio, fire alarm monitoring, and other potential systems.
  - l. Police two-way radio control consoles/units.
- B. Security Console Bays - shall be EIA 310D compliant and:
- 1. Utilize stand-up, sit-down, and vertical equipment racks in any combination to monitor and control the security subsystems.
  - 2. Shall be wide enough for equipment that requires a minimum 19 inch (47.5 cm) mounting area.
  - 3. Shall be made of metal, furnished with wire ways, a power strip, a thermostatic controlled bottom or top mounted fan units, a hinge mounted rear door, a hinge mounted front door made of Plexiglas, and a louvered top. When possible, pre-fabricated (standard off-the-shelf) security console equipment shall be used in place of customized designed consoles.
  - 4. A wire management system shall be designed and installed so that all cables are mounted in a manner that they do not interfere with day-to-day operations, are labeled for quick identification, and so that high voltage power cables do not cause signal interference with low voltage and data carrying cables.
  - 5. Shall be mounted on lockable casters.
  - 6. Shall be ergonomically designed so that all devices requiring repetitive interaction with by the operator can be easily accessed, observed, and accomplished.
  - 7. Controls and displays shall be located so that they are not obscured during normal operation. Control and display units installed with a work bench shall be a minimum of 3 in. (7.5 cm) from all edges of the work bench area.
  - 8. All security subsystem controls shall be installed within the same operating console bay of their associated equipment.
  - 9. Video monitors shall be mounted above all controls within a console bay and positioned in a manner that minimum strain is placed on the operator viewing them at the console.
  - 10. At least one workbench for every three (3) console bays shall be provided free of control equipment to allow for appropriate operator workspace.
  - 11. All console devices shall be labeled and marked with a minimum of quarter inch bold print.

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12. All non-security related equipment that is required to be monitored shall be installed in a console bay separate from the security subsystem equipment and clearing be identified as such.

**C. Wires and Cables:**

1. Shall meet or exceed the manufactures recommendation for power and signals.
2. Shall be carried in an enclosed conduit system, utilizing electromagnetic tubing (EMT) to include the equivalent in flexible metal, rigid galvanized steel (RGS) to include the equivalent of liquid tight, polyvinylchloride (PVC) schedule 40 or 80.
3. All conduits will be sized and installed per the NEC. All security system signal and power cables that traverse or originate in a high security office space will contained in either EMT or RGS conduit.
4. All conduit, pull boxes, and junction boxes shall be marked with colored permanent tape or paint that will allow it to be distinguished from all other infrastructure conduit.
5. Conduit fills shall not exceed 50 percent unless otherwise documented.
6. A pull string shall be pulled along and provided with signal and power cables to assist in future installations.
7. At all locations where there is a wall penetration or core drilling is conducted to allow for conduit to be installed, fire stopping materials shall be applied to that area.
8. High voltage and signal cables shall not share the same conduit and shall be kept separate up to the point of connection. High voltage for the security subsystems shall be any cable or sets of cables carrying 30 VDC/VAC or higher.
9. For all equipment that is carrying digital data between the Security Control Room, Security Equipment Room, Security Console, or at a remote monitoring station, it shall not be less that 20 AWG and stranded copper wire for each conductor. The cable or each individual conductor within the cable shall have a shield that provides 100% coverage. Cables with a single overall shield shall have a tinned copper shield drain wire.

**2.3 TRANSIENT VOLTAGE SURGE SUPPRESSION DEVICES (TVSS) AND SURGE SUPPRESION**

**A. Transient Voltage Surge Suppression:**

1. All cables and conductors extending beyond building perimeter, except fiber optic cables, which serve as communication, control, or signal lines shall be protected against Transient Voltage surges and have Transient Voltage surge suppression protection (TVSS) UL listed in

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accordance with Standard 497B installed at each end. Lighting and surge suppression shall be a multi-strike variety and include a fault indicator. Protection shall be furnished at the equipment and additional triple solid state surge protectors rated for the application on each wire line circuit shall be installed within 915 mm (36 in) of the building cable entrance. Fuses shall not be used for surge protection. The inputs and outputs shall be tested in both normal mode and common mode using the following waveforms:

- a. A 10-microsecond rise time by 1000 microsecond pulse width waveform with a peak voltage of 1500 volts and a peak current of 60 amperes.
- b. An 8-microsecond rise time by 20-microsecond pulse width waveform with a peak voltage of 1000 volts and a peak current of 500 amperes.
- c. Maximum series current: 2 AMPS. Provide units manufactured by Advanced Protection Technologies, model # TE/FA 10B or TE/FA 20B or approved equivalent.
- d. Operating Temperature and Humidity: -40 to + 85 deg C (-40 to 185 deg F), and 0 to 95 percent relative humidity, non-condensing.

**B. Physical Access Control Systems:**

1. Suppressors shall be installed on AC power at the point of service and shall meet the following criteria:
  - a. UL1449 2nd Edition, 2007, listed
  - b. UL1449 S.V.R. of 400 Volts or lower
  - c. Status Indicator Light(s)
  - d. Minimum Surge Current Capacity: 40,000 Amps (8 x 20  $\mu$ sec)
  - e. Maximum Continuous Current: 15 Amps
  - f. MCOV: 125 VAC
  - g. Service Voltage: 110-120 VAC
2. Suppressors shall be installed on the Low Voltage circuit at both the point of entrance and exit of the building. Suppressors shall meet the following criteria:
  - a. UL 497B
  - b. Minimum Surge Current Capacity: 2,000 Amps per pair
  - c. Maximum Continuous Current: 5 Amps
  - d. MCOV: 33 Volts
  - e. Service Voltage: 24Volts
3. Suppressors shall be installed on the communication circuit between the access controller and card reader at both the entrance and exit of the building. Suppressors shall meet the following criteria:

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- a. Conforms with UL497B standards (where applicable)
- b. Clamp level for 12 and 24V power: 18VDC / 38VDC
- c. Clamp level for Data/LED: 6.8VDC
- d. Service Voltage for Power: 12VDC/24VDC
- e. Service Voltage for Data/LED: <5VDC
- f. Clamp level - PoE Access Power: 72V
- g. Clamp level - PoE Access Data: 7.9V
- h. Service Voltage - PoE Access: 48VAC - 54VAC
- i. Service Voltage - PoE Data: <5VDC

**C. Intercom Systems:**

- 1. Suppressors shall be installed on the AC power at the point of service and shall meet the following criteria:
  - a. UL 1449 Listed
  - b. UL 1449 S.V.R. of 400 Volts or lower
  - c. Diagnostic Indicator Light(s)
  - d. Integrated ground terminating post (where case/chassis ground exists)
  - e. Minimum Surge Current Capacity of 13,000 Amps (8 x 20 µSec)
- 2. Suppressors shall be installed on incoming central office lines and shall meet the following criteria:
  - a. UL 497A Listed
  - b. Multi Stage protection design
  - c. Auto-reset current protection not to exceed 2 Amps per pair
  - d. Minimum Surge Current of 500 Amps per pair (8 x 20 µSec)
- 3. Suppressors shall be installed on all telephone/intercom circuits that enter or leave separate buildings and shall meet the following criteria:
  - a. UL 497A Listed (where applicable)
  - b. UL 497B Listed (horns, strobes, speakers or communication circuits over 300 feet)
  - c. Multi Stage protection design
  - d. Auto-reset over-current protection not to exceed 5 Amps per pair
  - e. Minimum Surge Current of 1000 Amps per pair (8 x 20 µSec)

**D. Video Surveillance System:**

- 1. Protectors shall be installed on coaxial cable systems on points of entry and exit from separate buildings. Suppressors shall be installed at each exterior camera location and include protection for 12 and/or 24 volt power, data signal and motor controls (for Pan, Tilt and Zoom systems). SPDs shall protect all modes herein mentioned and contain all modes in a single unit system. Protection



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for all systems mentioned above shall be incorporated at the head end equipment. Additionally a minimum 450VA battery backup shall be used to protect the DVR or VCR and monitor. Protectors shall meet the following criteria:

a. Head-End Power:

- 1) UL 1778, cUL (Battery Back Up)
- 2) Minimum Surge Current Capacity: 65,000 Amps (8x20µsec)
- 3) Minimum of two (2) NEMA 5-15R Receptacles (one (1) AC power only, one (1) with UPS)
- 4) All modes protected (L-N, L-G, N-G)
- 5) EMI/RFI Filtering
- 6) Maximum Continuous Current: 12 Amps

b. Camera Power

- 1) Minimum Surge Current Capacity: 1,000 Amps (8x20µsec); 240 Amps for IP Video/PoE cameras
- 2) Screw Terminal Connection
- 3) All protection modes L-G (all Lines)
- 4) MCOV <40VAC

c. Video and Data

- 1) Surge Current Capacity 1,000 Amps per conductor
- 2) "BNC" Connection (Coax)
- 3) Protection modes: L-G (Data), Center Pin-G, Shield-G (Coax)
- 4) Band Pass 0-2GHz
- 5) Insertion Loss <0.3dB

E. Grounding and Surge Suppression:

1. The Security Contractor shall provide grounding and surge suppression to stabilize the voltage under normal operating conditions. This is to ensure the operation of over current devices, such as fuses, circuit breakers, and relays, underground-fault conditions.
2. The Contractor shall engineer, provide, and install proper grounding and surge suppression as required by local jurisdiction and prevailing codes and standards, referenced in this document.
3. Principal grounding components and features shall include: main grounding buses, grounding, and bonding connections to service equipment.
4. The Contractor shall provide detail drawings of interconnection with other grounding systems including lightning protection systems.
5. The Contractor shall provide details of locations and sizes of grounding conductors and grounding buses in electrical, data, and communication equipment rooms and closets.

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6. AC power receptacles are not to be used as a ground reference point.
7. Any cable that is shielded shall require a ground in accordance with applicable codes, the best practices of the trade, and all manufactures' installation instructions.

**F. 120 VAC Surge SuppressionL:**

1. Continuous Current: Unlimited (parallel connection)
2. Max Surge Current: 13,500 Amps
3. Protection Modes: L - N, L - G, N - G
4. Warranty: Ten Year Limited Warranty
5. Dimension: 73.7 x 41.1 x 52.1 mm (2.90 x 1.62 x 2.05 in)
6. Weight: 2.88 g (0.18 lbs)
7. Housing: ABS

**2.4 INSTALLATION KIT**

**A. General:**

1. The kit shall be provided that, at a minimum, includes all connectors and terminals, labeling systems, audio spade lugs, barrier strips, punch blocks or wire wrap terminals, heat shrink tubing, cable ties, solder, hangers, clamps, bolts, conduit, cable duct, and/or cable tray, etc., required to accomplish a neat and secure installation. All wires shall terminate in a spade lug and barrier strip, wire wrap terminal or punch block. Unfinished or unlabeled wire connections shall not be allowed. All unused and partially opened installation kit boxes, coaxial, fiber-optic, and twisted pair cable reels, conduit, cable tray, and/or cable duct bundles, wire rolls, physical installation hardware shall be turned over to the Contracting Officer. The following sections outline the minimum required installation sub-kits to be used:
2. System Grounding:
  - a. The grounding kit shall include all cable and installation hardware required. All head end equipment and power supplies shall be connected to earth ground via internal building wiring, according to the NEC.
  - b. This includes, but is not limited to:
    - 1) Coaxial Cable Shields
    - 2) Control Cable Shields
    - 3) Data Cable Shields
    - 4) Equipment Racks
    - 5) Equipment Cabinets
    - 6) Conduits
    - 7) Cable Duct blocks

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- 8) Cable Trays
  - 9) Power Panels
  - 10) Grounding
  - 11) Connector Panels
3. Coaxial Cable: The coaxial cable kit shall include all coaxial connectors, cable tying straps, heat shrink tabbing, hangers, clamps, etc., required to accomplish a neat and secure installation.
  4. Wire and Cable: The wire and cable kit shall include all connectors and terminals, audio spade lugs, barrier straps, punch blocks, wire wrap strips, heat shrink tubing, tie wraps, solder, hangers, clamps, labels etc., required to accomplish a neat and orderly installation.
  5. Conduit, Cable Duct, and Cable Tray: The kit shall include all conduit, duct, trays, junction boxes, back boxes, cover plates, feed through nipples, hangers, clamps, other hardware required to accomplish a neat and secure conduit, cable duct, and/or cable tray installation in accordance with the NEC and this document.
  6. Equipment Interface: The equipment kit shall include any item or quantity of equipment, cable, mounting hardware and materials needed to interface the systems with the identified sub-system(s) according to the OEM requirements and this document.
  7. Labels: The labeling kit shall include any item or quantity of labels, tools, stencils, and materials needed to label each subsystem according to the OEM requirements, as-installed drawings, and this document.
  8. Documentation: The documentation kit shall include any item or quantity of items, computer discs, as installed drawings, equipment, maintenance, and operation manuals, and OEM materials needed to provide the system documentation as required by this document and explained herein.

**PART 3 - EXECUTION**

**3.1 COMMON REQUIREMENTS FOR ELECTRONIC SAFETY AND SECURITY INSTALLATION**

- A. Comply with NECA 1.
- B. Measure indicated mounting heights to bottom of unit for suspended items and to center of unit for wall-mounting items.
- C. Headroom Maintenance: If mounting heights or other location criteria are not indicated, arrange and install components and equipment to provide maximum possible headroom consistent with these requirements.
- D. Equipment: Install to facilitate service, maintenance, and repair or replacement of components of both electronic safety and security equipment and other nearby installations. Connect in such a way as to

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facilitate future disconnecting with minimum interference with other items in the vicinity.

- E. Right of Way: Give to piping systems installed at a required slope.
- F. Equipment location shall be as close as practical to locations shown on the drawings.
- G. Inaccessible Equipment:
  - 1. Where the Government determines that the Contractor has installed equipment not conveniently accessible for operation and maintenance, the equipment shall be removed and reinstalled as directed at no additional cost to the Government.
  - 2. "Conveniently accessible" is defined as being capable of being reached without the use of ladders, or without climbing or crawling under or over obstacles such as, but not limited to, motors, pumps, belt guards, transformers, piping, ductwork, conduit and raceways.

**3.2 FIRESTOPPING**

- A. Apply firestopping to penetrations of fire-rated floor and wall assemblies for electronic safety and security installations to restore original fire-resistance rating of assembly. Firestopping materials and installation requirements are specified in Division 07 Section 07 84 00 "Firestopping."

**3.3 DEMONSTRATION AND TRAINING**

- A. Training shall be provided in accordance with Article, INSTRUCTIONS, of Section 01 00 00, GENERAL REQUIREMENTS.
- B. Training shall be provided for the particular equipment or system as required in each associated specification.
- C. A training schedule shall be developed and submitted by the contractor and approved by the Resident Engineer at least 30 days prior to the planned training.
- D. Provide services of manufacturer's technical representative for <insert hours> hours to instruct VA personnel in operation and maintenance of units.
- E. Submit training plans and instructor qualifications in accordance with the requirements of Section 28 08 00 - COMMISSIONING OF ELECTRONIC SAFETY AND SECURITY SYSTEMS.

**3.4 WORK PERFORMANCE**

- A. Job site safety and worker safety is the responsibility of the contractor.
- B. For work on existing stations, arrange, phase and perform work to assure electronic safety and security service for other buildings at all times.

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Refer to Article OPERATIONS AND STORAGE AREAS under Section 01 00 00, GENERAL REQUIREMENTS.

- C. New work shall be installed and connected to existing work neatly and carefully. Disturbed or damaged work shall be replaced or repaired to its prior conditions, as required by Section 01 00 00, GENERAL REQUIREMENTS.
- D. Coordinate location of equipment and conduit with other trades to minimize interferences. See the GENERAL CONDITIONS.

**3.5 SYSTEM PROGRAMMING**

**A. General Programming Requirements:**

- 1. This following section shall be used by the contractor to identify the anticipated level of effort (LOE) required setup, program, and configure the Electronic Security System (ESS). The contractor shall be responsible for providing all setup, configuration, and programming to include data entry for the Security Management System (SMS) and subsystems [(e.g., video matrix switch, intercoms, digital video recorders, intrusion devices, including integration of subsystems to the SMS (e.g., camera call up, time synchronization, intercoms)]. System programming for existing or new SMS servers shall not be conducted at the project site.

**B. Level of Effort for Programming:**

- 1. The Contractor shall perform and complete system programming (including all data entry) at an offsite location using the Contractor's own copy of the SMS software. The Contractor's copy of the SMS software shall be of the VAMC's current version. Once system programming has been completed, the Contractor shall deliver the data to the Resident Engineer on data entry forms and an approved electronic medium, utilizing data from the contract documents. The completed forms shall be delivered to the Resident Engineer for review and approval at least 90 calendar days prior to the scheduled date the Contractor requires it. The Contractor shall not upload system programming until the Resident Engineer has provided written approval. The Contractor is responsible for backing up the system prior to uploading new programming data. Additional programming requirements are provided as follows:
  - a. Programming for New SMS Server: The contractor shall provide all other system related programming. The contractor will be responsible for uploading personnel information (e.g., ID Cards backgrounds, names, access privileges, personnel photos, access schedules, personnel groupings) along with coordinating with

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Resident Engineer for device configurations, standards, and groupings. VA shall provide database to support Contractor's data entry tasks. The contractor shall anticipate a weekly coordination meeting and working with Resident Engineer to ensure data uploading is performed without incident of loss of function or data loss.

- b. Programming for Existing SMS Servers: The contractor shall perform all related system programming except for personnel data as noted. The contractor will not be responsible for uploading personnel information (e.g., ID Cards backgrounds, names, access privileges, access schedules, personnel groupings). The contractor shall anticipate a weekly coordination meeting and working alongside of Resident Engineer to ensure data uploading is performed without incident of loss of function or data loss. System programming for SMS servers shall be performed by using the Contractor's own server and software. These servers shall not be connected to existing devices or systems at any time.
2. The Contractor shall identify and request from the Resident Engineer, any additional data needed to provide a complete and operational system as described in the contract documents.
3. Contractor and Resident Engineer coordination on programming requires a high level of coordination to ensure programming is performed in accordance with VA requirements and programming uploads do not disrupt existing systems functionality. The contractor shall anticipate a minimum a weekly coordination meeting. Contractor shall ensure data uploading is performed without incident of loss of function or data loss. The following Level of Effort Chart is provided to communicate the expected level of effort required by contractors on VA ESS projects. Calculations to determine actual levels of effort shall be confirmed by the contractor before project award.

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Description of Systems	Description of Tasks						
	Develop System Loading Sheets	Coordination	Initial Set-up Configuration	Graphic Maps	System Programming	Final Checks	Level of Effort (Typical Tasks)
SMS Setup & Configuration	e.g., program monitoring stations, programming networks, interconnections between CCTV, intercoms, time synchronization	e.g., retrieve IP addresses, naming conventions, standard event descriptions, programming templates, coordinate special system needs	e.g., Load system Operating System and Application software, general system configurations	e.g., develop naming conventions, develop file folders	e.g., programming monitoring stations, programming networks, interconnections between CCTV, intercoms, time synchronization	e.g., check all system diagnostics (e.g., clients, panels)	Load and set-up 4-6 CDs and configure servers (to configure Loading and Configuring software  Administrative account, audit log,  Keystrokes, mouse clicks, multi-screen configuration
Electronic Entry Control Systems	e.g., setup of device, door groups & schedules, REX, Locks, link graphics	e.g., confirming device configurations, naming conventions, event description and narratives	e.g., enter data from loading sheets; configure components, link events, cameras, and graphics	confirming accuracy of AutoCAD Floor Plans, convert file into jpeg file	e.g., setup of device groups & schedules, REX, Locks, link graphics	e.g., performing entry testing to confirm correct set-up and configuration	e.g., creating a door, door configuration, adding request to exit, door monitors and relays, door timers, door related events (e.g., access, access denied, forced open, held open), linkages, controlled areas, advanced door monitoring, time zones, sequence of operations

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CCTV Systems	e.g., programming call-ups recording	e.g., confirming device configurations, naming conventions	e.g., enter data from loading sheets; camera naming convention, sequences, configure components)		e.g., programming call-ups recording	e.g., confirm area of coverage, call-up per event generated and recording rates	e.g., setting up cameras points, recording ratios (e.g., normal, alarm event) timed recording, linkages, maps placements, call-ups
Console Monitoring Components	N/A	per monitor	per monitor		N/A	per monitor	N/A
Note: Programming tasks are supported through the contractor's development of the Technical Data Package Submittals.				per graphic map			

**Table 1 Contractor Level of Effort**

### 3.6 TESTING AND ACCEPTANCE

A. Performance Requirements:

1. General:

- a. The Contractor shall perform contract field, performance verification, and endurance testing and make adjustments of the completed security system when permitted. The Contractor shall provide all personnel, equipment, instrumentation, and supplies necessary to perform all testing. Written notification of planned testing shall be given to the Resident Engineer at least 60 calendar days prior to the test and after the Contractor has received written approval of the specific test procedures.
- b. The COTR shall witness all testing and system adjustments during testing. Written permission shall be obtained from the Resident Engineer before proceeding with the next phase of testing.



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Original copies of all data produced during performance verification and endurance testing shall be turned over to the Resident Engineer at the conclusion of each phase of testing and prior to Resident Engineer approval of the test.

2. Test Procedures and Reports: The test procedures, compliant w/ VA standard test procedures, shall explain in detail, step-by-step actions and expected results demonstrating compliance with the requirements of the specification. The test reports shall be used to document results of the tests. The reports shall be delivered to the Resident Engineer within seven (7) calendar days after completion of each test.

**B. Pre-Delivery Testing:**

1. The purpose of the pre-delivery test is to establish that a system is suitable for installation. As such, pre-delivery test shall be a mock-up of the system as planned in the contract documents. The Contractor shall assemble the Security Test System at the Contractors local project within 50-miles of the project site, and perform tests to demonstrate the performance of the system complies with the contract requirements in accordance with the approved pre-delivery test procedures. The tests shall take place during regular daytime working hours on weekdays. Model numbers of equipment tested shall be identical to those to be delivered to the site. Original copies of all data produced during pre-delivery testing, including results of each test procedure, shall be documented and delivered to the Resident Engineer at the conclusion of pre-delivery testing and prior to Resident Engineer's approval of the test. The test report shall be arranged so all commands, stimuli, and responses are correlated to allow logical interpretation. For Existing System modifications, the contractor shall provide their own server with loaded applicable software to support PDT.
2. Test Setup: The pre-delivery test setup shall include the following:
  - a. All console equipment.
    - 1) At least one of each type of data transmission media (DTM) and associated equipment to provide a fully integrated PACS.
    - 2) The number of local processors shall equal the amount required by the site design.
    - 3) Enough sensor simulators to provide alarm signal inputs to the system equal to the number of sensors required by the design. The alarm signals shall be manually or software generated.

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- 4) Contractor to prove to Resident Engineer all systems are appropriately sized and configured as sized.
  - 5) Integration of VASS, intercom systems, other subsystems.
3. During the bidding process the contractor shall submit a request for information to the Resident Engineer to determine if a pre-delivery test will be required. If a pre-delivery test is not required, the contractor shall provide a written notification that the Pre-delivery Test is not required in their shop drawings submission.
- C. The inspection and test will be conducted by a factory-certified contractor representative and witnessed by a Government Representative. The results of the inspection will be officially recorded by a designated Government Representative and maintained on file by the Resident Engineer (RE), until completion of the entire project. The results will be compared to the Acceptance Test results.
- D. Contractor's Field Testing (CFT):
1. The Contractor shall calibrate and test all equipment, verify DTM operation, place the integrated system in service, and test the integrated system. Ground rods installed by this Contractor within the base of camera poles shall be tested as specified in IEEE STD 142. The Contractor shall test all security systems and equipment, and provide written proof of a 100% operational system before a date is established for the system acceptance test. Documentation package for CFT shall include completed (fully annotated details of test details) for each device and system tested, and annotated loading sheets documenting complete testing to Resident Engineer approval. CFT test documentation package shall conform to submittal requirements outlined in this Section. The Contractor's field testing procedures shall be identical to the Resident Engineer's acceptance testing procedures. The Contractor shall provide the Resident Engineer with a written listing of all equipment and software indicating all equipment and components have been tested and passed. The Contractor shall deliver a written report to the Resident Engineer stating the installed complete system has been calibrated, tested, and is ready to begin performance verification testing; describing the results of the functional tests, diagnostics, and calibrations; and the report shall also include a copy of the approved acceptance test procedure. Performance verification testing shall not take place until written notice by contractor is received certifying that a contractors field test was successful.
- E. Performance Verification Test (PVT):

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1. Test team:
  - a. After the system has been pretested and the Contractor has submitted the pretest results and certification to the Resident Engineer, then the Contractor shall schedule an acceptance test to date and give the Resident Engineer written, notice as described herein, prior to the date the acceptance test is expected to begin. The system shall be tested in the presence of a Government Representative, an OEM certified representative, representative of the Contractor and other approved by the Resident Engineer. The system shall be tested utilizing the approved test equipment to certify proof of performance, FCC, UL and Emergency Service compliance. The test shall verify that the total system meets all the requirements of this specification. The notification of the acceptance test shall include the expected length (in time) of the test.
2. The Contractor shall demonstrate the completed Physical Access Control System PACS complies with the contract requirements. In addition, the Contractor shall provide written certification that the system is 100% operational prior to establishing a date for starting PVT. Using approved test procedures, all physical and functional requirements of the project shall be demonstrated and shown. The PVT will be stopped and aborted as soon as 10 technical deficiencies are found requiring correction. The Contractor shall be responsible for all travel and lodging expenses incurred for out-of-town personnel required to be present for resumption of the PVT. If the acceptance test is aborted, the re-test will commence from the beginning with a retest of components previously tested and accepted.
3. The PVT, as specified, shall not begin until receipt of written certification that the Contractors Field Testing was successful. This shall include certification of successful completion of testing as specified in paragraph "Contractor's Field Testing", and upon successful completion of testing at any time when the system fails to perform as specified. Upon termination of testing by the Resident Engineer or Contractor, the Contractor shall commence an assessment period as described for Endurance Testing Phase II.
4. Upon successful completion of the acceptance test, the Contractor shall deliver test reports and other documentation, as specified, to the Resident Engineer prior to commencing the endurance test.
5. Additional Components of the PVT shall include:
  - a. System Inventory

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- 1) All Device equipment
- 2) All Software
- 3) All Logon and Passwords
- 4) All Cabling System Matrices
- 5) All Cable Testing Documents
- 6) All System and Cabinet Keys

b. Inspection:

- 1) Contractor shall record an inspection punch list noting all system deficiencies. The contractor shall prepare an inspection punch list format for Resident Engineers approval.
- 2) As a minimum the punch list shall include a listing of punch list items, punch list item location, description of item problem, date noted, date corrected, and details of how item was corrected.

6. Partial PVT - At the discretion of Resident engineer, the Performance Verification Test may be performed in part should a 100% compliant CFT be performed. In the event that a partial PVT will be performed instead of a complete PVT; the partial PVT shall be performed by testing 10% of the system. The contractor shall perform a test of each procedure on select devices or equipment.

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**F. Endurance Test:**

1. The Contractor shall demonstrate the specified probability of detection and false alarm rate requirements of the completed system. The endurance test shall be conducted in phases as specified below. The endurance test shall not be started until the Resident Engineer notifies the Contractor, in writing, that the performance verification test is satisfactorily completed, training as specified has been completed, and correction of all outstanding deficiencies has been satisfactorily completed. VA shall operate the system 24 hours per day, including weekends and holidays, during Phase I and Phase III endurance testing. VA will maintain a log of all system deficiencies. The Resident Engineer may terminate testing at any time the system fails to perform as specified. Upon termination of testing, the Contractor shall commence an assessment period as described for Phase II. During the last day of the test, the Contractor shall verify the appropriate operation of the system. Upon successful completion of the endurance test, the Contractor shall deliver test reports and other documentation as specified to the Resident Engineer prior to acceptance of the system.
2. Phase I (Testing): The test shall be conducted 24 hours per day for 15 consecutive calendar days, including holidays, and the system shall operate as specified. The Contractor shall make no repairs during this phase of testing unless authorized in writing by the Resident Engineer. If the system experiences no failures, the Contractor may proceed directly to Phase III testing after receiving written permission from the Resident Engineer.
3. Phase II (Assessment):
  - a. After the conclusion of Phase I, the Contractor shall identify all failures, determine causes of all failures, repair all failures, and deliver a written report to the Resident Engineer. The report shall explain in detail the nature of each failure, corrective action taken, results of tests performed, and recommend the point at which testing should be resumed.
  - b. After delivering the written report, the Contractor shall convene a test review meeting at the job site to present the results and recommendations to the Resident Engineer. The meeting shall not be scheduled earlier than five (5) business days after the Resident Engineer receives the report. As part of this test review meeting, the Contractor shall demonstrate all failures have been corrected by performing appropriate portions of the

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performance verification test. Based on the Contractor's report and the test review meeting, the Resident Engineer will provide a written determine of either the restart date or require Phase I be repeated.

4. Phase III (Testing): The test shall be conducted 24 hours per day for 15 consecutive calendar days, including holidays, and the system shall operate as specified. The Contractor shall make no repairs during this phase of testing unless authorized in writing by the COTR.

5. Phase IV (Assessment):

- a. After the conclusion of Phase III, the Contractor shall identify all failures, determine causes of all failures, repair all failures, and deliver a written report to the COTR. The report shall explain in detail the nature of each failure, corrective action taken, results of tests performed, and recommend the point at which testing should be resumed.
- b. After delivering the written report, the Contractor shall convene a test review meeting at the job site to present the results and recommendations to the COTR. The meeting shall not be scheduled earlier than five (5) business days after receipt of the report by the COTR. As a part of this test review meeting, the Contractor shall demonstrate that all failures have been corrected by repeating appropriate portions for the performance verification test. Based on the review meeting the test should not be scheduled earlier than five (5) business days after the Resident Engineer receives the report. As a part of this test review meeting, the Contractor shall demonstrate all failures have been corrected by repeating appropriate portions of the performance verification test. Based on the Contractor's report and the test review meeting, the Resident Engineer will provide a written determine of either the restart date or require Phase III be repeated. After the conclusion of any re-testing which the Resident Engineer may require, the Phase IV assessment shall be repeated as if Phase III had just been completed.

G. Exclusions:

1. The Contractor will not be held responsible for failures in system performance resulting from the following:
  - a. An outage of the main power in excess of the capability of any backup power source provided the automatic initiation of all

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backup sources was accomplished and that automatic shutdown and restart of the PACS performed as specified.

- b. Failure of a VAMC furnished equipment or communications link, provided the failure was not due to Contractor furnished equipment, installation, or software.
- c. Failure of existing VAMC owned equipment, provided the failure was not due to Contractor furnished equipment, installation, or software.

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SECTION 28 05 13  
CONDUCTORS AND CABLES FOR ELECTRONIC SAFETY AND SECURITY

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This section specifies the finishing, installation, connection, testing and certification the conductors and cables required for a fully functional for electronic safety and security (ESS) system.

1.2 RELATED WORK

- A. Section 01 00 00 - GENERAL REQUIREMENTS. For General Requirements.
- B. Section 07 84 00 - FIRESTOPPING. Requirements for firestopping application and use.
- C. Section 28 05 00 - COMMON WORK RESULTS FOR ELECTRONIC SAFETY AND SECURITY. Requirements for general requirements that are common to more than one section in Division 28.
- D. Section 28 05 26 - GROUNDING AND BONDING FOR ELECTRONIC SAFETY AND SECURITY. Requirements for personnel safety and to provide a low impedance path for possible ground fault currents.
- E. Section 28 05 28.33 - CONDUITS AND BOXES FOR ELECTRONIC SECURITY AND SAFETY. Requirements for infrastructure.

1.3 DEFINITIONS

- A. BICSI: Building Industry Consulting Service International.
- B. EMI: Electromagnetic interference.
- C. IDC: Insulation displacement connector.
- D. Ladder Cable Tray: A fabricated structure consisting of two longitudinal side rails connected by individual transverse members (rungs).
- E. Low Voltage: As defined in NFPA 70 for circuits and equipment operating at less than 50 V or for remote-control and signaling power-limited circuits.
- F. Open Cabling: Passing telecommunications cabling through open space (e.g., between the studs of a wall cavity).
- G. RCDD: Registered Communications Distribution Designer.
- H. Solid-Bottom or Nonventilated Cable Tray: A fabricated structure consisting of integral or separate longitudinal side rails, and a bottom without ventilation openings.
- I. Trough or Ventilated Cable Tray: A fabricated structure consisting of integral or separate longitudinal rails and a bottom having openings sufficient for the passage of air and using 75 percent or less of the plan area of the surface to support cables.
- J. UTP: Unshielded twisted pair.

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**1.4 QUALITY ASSURANCE**

- A. See section 28 05 00, Paragraph 1.4.

**1.5 SUBMITTALS**

- A. In accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES, furnish the following:
1. Manufacturer's Literature and Data: Showing each cable type and rating.
  2. Certificates: Two weeks prior to final inspection, deliver to the Resident Engineer/COTR four copies of the certification that the material is in accordance with the drawings and specifications and diagrams for cable management system.
  3. Shop Drawings: Cable tray layout, showing cable tray route to scale, with relationship between the tray and adjacent structural, electrical, and mechanical elements. Include the following:
    - a. Vertical and horizontal offsets and transitions.
    - b. Clearances for access above and to side of cable trays.
    - c. Vertical elevation of cable trays above the floor or bottom of ceiling structure.
    - d. Load calculations to show dead and live loads as not exceeding manufacturer's rating for tray and its support elements.
    - e. System labeling schedules, including electronic copy of labeling schedules that are part of the cable and asset identification system of the software specified in Parts 2 and 3.
  4. Wiring Diagrams. Show typical wiring schematics including the following:
    - a. Workstation outlets, jacks, and jack assemblies.
    - b. Patch cords.
    - c. Patch panels.
  5. Cable Administration Drawings: As specified in Part 3 "Identification" Article.
  6. Project planning documents as specified in Part 3.
  7. Maintenance Data: For wire and cable to include in maintenance manuals.

**1.6 APPLICABLE PUBLICATIONS**

- A. Publications listed below (including amendments, addenda, revisions, supplements and errata) form a part of this specification to the extent referenced. Publications are reference in the text by the basic designation only.

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- B. American Society of Testing Material (ASTM):
  - D2301-04 .....Standard Specification for Vinyl Chloride  
Plastic Pressure Sensitive Electrical Insulating  
Tape
- C. Federal Specifications (Fed. Spec.):
  - A-A-59544-08 .....Cable and Wire, Electrical (Power, Fixed  
Installation)
- D. National Fire Protection Association (NFPA):
  - 70-11 .....National Electrical Code (NEC)
- E. Underwriters Laboratories, Inc. (UL):
  - 44-05 .....Thermoset-Insulated Wires and Cables
  - 83-08 .....Thermoplastic-Insulated Wires and Cables
  - 467-07 .....Electrical Grounding and Bonding Equipment
  - 486A-03 .....Wire Connectors and Soldering Lugs for Use with  
Copper Conductors
  - 486C-04 .....Splicing Wire Connectors
  - 486D-05 .....Insulated Wire Connector Systems for Underground  
Use or in Damp or Wet Locations
  - 486E-00 .....Equipment Wiring Terminals for Use with Aluminum  
and/or Copper Conductors
  - 493-07 .....Thermoplastic-Insulated Underground Feeder and  
Branch Circuit Cable
  - 514B-04 .....Fittings for Cable and Conduit
  - 1479-03 .....Fire Tests of Through-Penetration Fire Stops

**1.7 DELIVERY, STORAGE, AND HANDLING**

- A. Test cables upon receipt at Project site.
  - 1. Test optical fiber cable to determine the continuity of the strand  
end to end. Use optical loss test set.
  - 2. Test optical fiber cable on reels. Use an optical time domain  
reflectometer to verify the cable length and locate cable defects,  
splices, and connector; include the loss value of each. Retain test  
data and include the record in maintenance data.
  - 3. Test each pair of UTP cable for open and short circuits.

**1.8 PROJECT CONDITIONS**

- A. Environmental Limitations: Do not deliver or install UTP, optical  
fiber, and coaxial cables and connecting materials until wet work in  
spaces is complete and dry, and temporary HVAC system is operating and  
maintaining ambient temperature and humidity conditions at occupancy  
levels during the remainder of the construction period.

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**PART 2 - PRODUCTS**

**2.1 GENERAL**

- A. Support of Open Cabling: NRTL labeled for support of Category 6 cabling, designed to prevent degradation of cable performance and pinch points that could damage cable.
  - 1. Support brackets with cable tie slots for fastening cable ties to brackets.
  - 2. Lacing bars, spools, J-hooks, and D-rings.
  - 3. Straps and other devices.
- B. Cable Trays:
  - 1. Cable Tray Materials: Metal, suitable for indoors, and protected against corrosion by electroplated zinc galvanizing, complying with ASTM B 633, Type 1, not less than 0.000472 inch (0.012 mm) thick.
  - 2. Basket Cable Trays: 6 inches (150 mm) wide and 2 inches (50 mm) deep. Wire mesh spacing shall not exceed 2 by 4 inches (50 by 100 mm).
- C. Conduit and Boxes: Comply with requirements in Division 28 Section "Conduits and Backboxes for Electrical Systems."
  - 1. Outlet boxes shall be no smaller than 2 inches (50 mm) wide, 3 inches (75 mm) high, and 2-1/2 inches (64 mm) deep.

**2.2 BACKBOARDS**

- A. Backboards: Plywood, fire-retardant treated, 3/4 by 48 by 96 inches (19 by 1220 by 2440 mm). Comply with requirements for plywood backing panels in Division 06 Section "Rough Carpentry".

**2.3 UTP CABLE**

- A. Description: 100-ohm, 4-pair UTP, formed into 25-pair binder groups covered with a blue thermoplastic jacket.
  - 1. Comply with ICEA S-90-661 for mechanical properties.
  - 2. Comply with TIA/EIA-568-B.1 for performance specifications.
  - 3. Comply with TIA/EIA-568-B.2, Category 6.
  - 4. Listed and labeled by an NRTL acceptable to authorities having jurisdiction as complying with UL 444 and NFPA 70 for the following types:
    - a. Communications, Plenum Rated: Type CMP, complying with NFPA 262.
    - b. Communications, Riser Rated: Type CMR, complying with UL 1666.
    - c. Multipurpose, Plenum Rated: Type MPP, complying with NFPA 262.
    - d. Multipurpose, Riser Rated: Type MPR, complying with UL 1666.

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**2.4 UTP CABLE HARDWARE**

- A. UTP Cable Connecting Hardware: IDC type, using modules designed for punch-down caps or tools. Cables shall be terminated with connecting hardware of the same category or higher.
- B. Connecting Blocks: 110-style for Category 6. Provide blocks for the number of cables terminated on the block, plus 25 percent spare. Integral with connector bodies, including plugs and jacks where indicated.

**2.5 RS-232 CABLE**

- A. Standard Cable: NFPA 70, Type CM.
  - 1. Paired, 2 pairs, No. 22 AWG, stranded (7x30) tinned copper conductors.
  - 2. Polypropylene insulation.
  - 3. Individual aluminum foil-polyester tape shielded pairs with 100 percent shield coverage.
  - 4. PVC jacket.
  - 5. Pairs are cabled on common axis with No. 24 AWG, stranded (7x32) tinned copper drain wire.
  - 6. Flame Resistance: Comply with UL 1581.
- B. Plenum-Rated Cable: NFPA 70, Type CMP.
  - 1. Paired, 2 pairs, No. 22 AWG, stranded (7x30) tinned copper conductors.
  - 2. Plastic insulation.
  - 3. Individual aluminum foil-polyester tape shielded pairs with 100 percent shield coverage.
  - 4. Plastic jacket.
  - 5. Pairs are cabled on common axis with No. 24 AWG, stranded (7x32) tinned copper drain wire.
  - 6. Flame Resistance: Comply with NFPA 262.

**2.6 RS-485 CABLE**

- A. Standard Cable: NFPA 70, Type CM.
  - 1. Paired, 2 pairs, twisted, No. 22 AWG, stranded (7x30) tinned copper conductors.
  - 2. PVC insulation.
  - 3. Unshielded.
  - 4. PVC jacket.
  - 5. Flame Resistance: Comply with UL 1581.

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- B. Plenum-Rated Cable: NFPA 70, Type CMP.
  - 1. Paired, 2 pairs, No. 22 AWG, stranded (7x30) tinned copper conductors.
  - 2. Fluorinated ethylene propylene insulation.
  - 3. Unshielded.
  - 4. Fluorinated ethylene propylene jacket.
  - 5. Flame Resistance: NFPA 262, Flame Test.

**2.7 LOW-VOLTAGE CONTROL CABLE**

- A. Paired Lock Cable: NFPA 70, Type CMG.
  - 1. 1 pair, twisted, No. 16 AWG, stranded (19x29) tinned copper conductors.
  - 2. PVC insulation.
  - 3. Unshielded.
  - 4. PVC jacket.
  - 5. Flame Resistance: Comply with UL 1581.
- B. Plenum-Rated, Paired Lock Cable: NFPA 70, Type CMP.
  - 1. 1 pair, twisted, No. 16 AWG, stranded (19x29) tinned copper conductors.
  - 2. PVC insulation.
  - 3. Unshielded.
  - 4. PVC jacket.
  - 5. Flame Resistance: Comply with NFPA 262.
- C. Paired Lock Cable: NFPA 70, Type CMG.
  - 1. 1 pair, twisted, No. 18 AWG, stranded (19x30) tinned copper conductors.
  - 2. PVC insulation.
  - 3. Unshielded.
  - 4. PVC jacket.
  - 5. Flame Resistance: Comply with UL 1581.
- D. Plenum-Rated, Paired Lock Cable: NFPA 70, Type CMP.
  - 1. 1 pair, twisted, No. 18 AWG, stranded (19x30) tinned copper conductors.
  - 2. Fluorinated ethylene propylene insulation.
  - 3. Unshielded.
  - 4. Plastic jacket.
  - 5. Flame Resistance: NFPA 262, Flame Test.

**2.8 CONTROL-CIRCUIT CONDUCTORS**

- A. Class 1 Control Circuits: Stranded copper, Type THHN-THWN, in raceway complying with UL 83.

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- B. Class 2 Control Circuits: Stranded copper, Type THHN-THWN, in raceway complying with UL 83.
- C. Class 3 Remote-Control and Signal Circuits: Stranded copper, Type TW or TF, complying with UL 83.

**2.9 IDENTIFICATION PRODUCTS**

- A. Comply with UL 969 for a system of labeling materials, including label stocks, laminating adhesives, and inks used by label printers.

**2.10 SOURCE QUALITY CONTROL**

- A. Testing Agency: Engage a qualified testing agency to evaluate cables.
- B. Factory test UTP and optical fiber cables on reels according to TIA/EIA-568-B.1.
- C. Factory test UTP cables according to TIA/EIA-568-B.2.
- D. Factory test multimode optical fiber cables according to TIA/EIA-526-14-A and TIA/EIA-568-B.3.
- E. Cable will be considered defective if it does not pass tests and inspections.
- F. Prepare test and inspection reports.

**2.11 WIRE LUBRICATING COMPOUND**

- A. Suitable for the wire insulation and conduit it is used with, and shall not harden or become adhesive.
- B. Shall not be used on wire for isolated type electrical power systems.

**2.12 FIREPROOFING TAPE**

- A. The tape shall consist of a flexible, conformable fabric of organic composition coated one side with flame-retardant elastomer.
- B. The tape shall be self-extinguishing and shall not support combustion. It shall be arc-proof and fireproof.
- C. The tape shall not deteriorate when subjected to water, gases, salt water, sewage, or fungus and be resistant to sunlight and ultraviolet light.
- D. The finished application shall withstand a 200-ampere arc for not less than 30 seconds.
- E. Securing tape: Glass cloth electrical tape not less than 0.18 mm (7 mils) thick, and 19 mm (3/4 inch) wide.

**PART 3 - EXECUTION**

**3.1 INSTALLATION OF CONDUCTORS AND CABLES**

- A. Comply with NECA 1.
- B. General Requirements for Cabling:
  - 1. Comply with TIA/EIA-568-B.1.
  - 2. Comply with BICSI ITSIM, Ch. 6, "Cable Termination Practices."

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3. Install 110-style IDC termination hardware unless otherwise indicated.
4. Terminate all conductors; no cable shall contain un-terminated elements. Make terminations only at indicated outlets, terminals, and cross-connect and patch panels.
5. Cables may not be spliced. Secure and support cables at intervals not exceeding 30 inches (760 mm) and not more than 6 inches (150 mm) from cabinets, boxes, fittings, outlets, racks, frames, and terminals.
6. Bundle, lace, and train conductors to terminal points without exceeding manufacturer's limitations on bending radii, but not less than radii specified in BICSI ITSIM, "Cabling Termination Practices" Chapter. Install lacing bars and distribution spools.
7. Do not install bruised, kinked, scored, deformed, or abraded cable. Do not splice cable between termination, tap, or junction points. Remove and discard cable if damaged during installation and replace it with new cable.
8. Cold-Weather Installation: Bring cable to room temperature before dereeling. Heat lamps shall not be used for heating.
9. Pulling Cable:
  - a. Comply with BICSI ITSIM, Ch. 4, "Pulling Cable." Monitor cable pull tensions.
  - b. Provide installation equipment that will prevent the cutting or abrasion of insulation during pulling of cables.
  - c. Use ropes made of nonmetallic material for pulling feeders.
  - d. Attach pulling lines for feeders by means of either woven basket grips or pulling eyes attached directly to the conductors, as approved by the Resident Engineer/COTR.
  - e. Pull in multiple cables together in a single conduit.
- C. Splice cables and wires where necessary only in outlet boxes, junction boxes, or pull boxes.
  1. Splices and terminations shall be mechanically and electrically secure.
  2. Where the Government determines that unsatisfactory splices or terminations have been installed, remove the devices and install approved devices at no additional cost to the Government.
- D. Seal cable and wire entering a building from underground, between the wire and conduit where the cable exits the conduit, with a non-hardening approved compound.



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- E. Unless otherwise specified in other sections install wiring and connect to equipment/devices to perform the required functions as shown and specified.
- F. Except where otherwise required, install a separate power supply circuit for each system so that malfunctions in any system will not affect other systems.
- G. Where separate power supply circuits are not shown, connect the systems to the nearest panel boards of suitable voltages, which are intended to supply such systems and have suitable spare circuit breakers or space for installation.
- H. Install a red warning indicator on the handle of the branch circuit breaker for the power supply circuit for each system to prevent accidental de-energizing of the systems.
- I. System voltages shall be 120 volts or lower where shown on the drawings or as required by the NEC.
- J. UTP Cable Installation:
  - 1. Comply with TIA/EIA-568-B.2.
  - 2. Do not untwist UTP cables more than 1/2 inch (12 mm) from the point of termination to maintain cable geometry.
- K. Open-Cable Installation:
  - 1. Install cabling with horizontal and vertical cable guides in telecommunications spaces with terminating hardware and interconnection equipment.
  - 2. Suspend copper cable not in a wireway or pathway a minimum of 8 inches (200 mm) above ceilings by cable supports not more than 60 inches (1525 mm) apart.
  - 3. Cable shall not be run through structural members or in contact with pipes, ducts, or other potentially damaging items.
- L. Separation from EMI Sources:
  - 1. Comply with BICSI TDMM and TIA/EIA-569-A recommendations for separating unshielded copper voice and data communication cable from potential EMI sources, including electrical power lines and equipment.
  - 2. Separation between open communications cables or cables in nonmetallic raceways and unshielded power conductors and electrical equipment shall be as follows:
    - a. Electrical Equipment Rating Less Than 2 kVA: A minimum of 5 inches (127 mm).
    - b. Electrical Equipment Rating between 2 and 5 kVA: A minimum of 12 inches (300 mm).

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- c. Electrical Equipment Rating More Than 5 kVA: A minimum of 24 inches (600 mm).
- 3. Separation between communications cables in grounded metallic raceways and unshielded power lines or electrical equipment shall be as follows:
  - a. Electrical Equipment Rating Less Than 2 kVA: A minimum of 2-1/2 inches (64 mm).
  - b. Electrical Equipment Rating between 2 and 5 kVA: A minimum of 6 inches (150 mm).
  - c. Electrical Equipment Rating More Than 5 kVA: A minimum of 12 inches (300 mm).
- 4. Separation between communications cables in grounded metallic raceways and power lines and electrical equipment located in grounded metallic conduits or enclosures shall be as follows:
  - a. Electrical Equipment Rating Less Than 2 kVA: No requirement.
  - b. Electrical Equipment Rating between 2 and 5 kVA: A minimum of 3 inches (75 mm).
  - c. Electrical Equipment Rating More Than 5 kVA: A minimum of 6 inches (150 mm).
- 5. Separation between Cables and Electrical Motors and Transformers, 5 kVA or HP and Larger: A minimum of 48 inches (1200 mm).
- 6. Separation between Cables and Fluorescent Fixtures: A minimum of 5 inches (127 mm).

**3.2 CONTROL CIRCUIT CONDUCTORS**

- A. Minimum Conductor Sizes:
  - 1. Class 1 remote-control and signal circuits, No. 14 AWG.
  - 2. Class 2 low-energy, remote-control and signal circuits, No. 16 AWG.
  - 3. Class 3 low-energy, remote-control, alarm and signal circuits, No. 12 AWG.

**3.3 CONNECTIONS**

- A. Comply with requirements in Division 28 Section, PHYSICAL ACCESS CONTROL for connecting, terminating, and identifying wires and cables.
- B. Comply with requirements in Division 28 Section "VIDEO SURVEILLANCE" for connecting, terminating, and identifying wires and cables.
- C. Comply with requirements in Division 28 Section "ELECTRONIC PERSONAL PROTECTION SYSTEMS" for connecting, terminating, and identifying wires and cables.
- D. Comply with requirements in Division 28 Section "FIRE DETECTION AND ALARM" for connecting, terminating, and identifying wires and cables.

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**3.4 FIRESTOPPING**

- A. Comply with requirements in Division 07 Section "PENETRATION FIRESTOPPING."
- B. Comply with TIA/EIA-569-A, "Firestopping" Annex A.
- C. Comply with BICSI TDMM, "Firestopping Systems" Article.

**3.5 GROUNDING**

- A. For communications wiring, comply with ANSI-J-STD-607-B and with BICSI TDMM, "Grounding, Bonding, and Electrical Protection" Chapter.
- B. For low-voltage wiring and cabling, comply with requirements in Division 28 Section "GROUNDING AND BONDING FOR ELECTRONIC SAFETY AND SECURITY."

**3.6 IDENTIFICATION**

- A. Identify system components, wiring, and cabling complying with TIA/EIA-606-B.
- B. Install a permanent wire marker on each wire at each termination.
- C. Identifying numbers and letters on the wire markers shall correspond to those on the wiring diagrams used for installing the systems.
- D. Wire markers shall retain their markings after cleaning.

**3.7 FIELD QUALITY CONTROL**

- A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.
- B. Perform tests and inspections.
- C. Tests and Inspections:
  - 1. Visually inspect UTP and optical fiber cable jacket materials for UL or third-party certification markings. Inspect cabling terminations to confirm color-coding for pin assignments, and inspect cabling connections to confirm compliance with TIA/EIA-568-B.1.
  - 2. Visually inspect cable placement, cable termination, grounding and bonding, equipment and patch cords, and labeling of all components.
  - 3. Test UTP cabling for DC loop resistance, shorts, opens, intermittent faults, and polarity between conductors. Test operation of shorting bars in connection blocks. Test cables after termination but not cross connection.
    - a. Test instruments shall meet or exceed applicable requirements in TIA/EIA-568-B.2. Perform tests with a tester that complies with performance requirements in "Test Instruments (Normative)" Annex, complying with measurement accuracy specified in "Measurement Accuracy (Informative)" Annex. Use only test cords and adapters that are qualified by test equipment manufacturer for channel or link test configuration.

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- D. Document data for each measurement. Print data for submittals in a summary report that is formatted using Table 10.1 in BICSI TDMM as a guide, or transfer the data from the instrument to the computer, save as text files, print, and submit.
- E. End-to-end cabling will be considered defective if it does not pass tests and inspections.
- F. Prepare test and inspection reports.

**3.8 EXISTING WIRING**

- A. Unless specifically indicated on the plans, existing wiring shall not be reused for the new installation. Only wiring that conforms to the specifications and applicable codes may be reused. If existing wiring does not meet these requirements, existing wiring may not be reused and new wires shall be installed.

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SECTION 28 05 26  
GROUNDING AND BONDING FOR ELECTRONIC SAFETY AND SECURITY

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

- A. This section specifies the finishing, installation, connection, testing and certification of the grounding and bonding required for a fully functional Electronic Safety and Security (ESS) system.
- B. "Grounding electrode system" refers to all electrodes required by NEC, as well as including made, supplementary, grounding electrodes.
- C. The terms "connect" and "bond" are used interchangeably in this specification and have the same meaning

**1.2 RELATED WORK**

- A. Section 01 00 00 - GENERAL REQUIREMENTS. For General Requirements.
- B. Section 28 05 00 - REQUIREMENTS FOR ELECTRONIC SAFETY AND SECURITY INSTALLATIONS. For general electrical requirements, quality assurance, coordination, and project conditions that are common to more than one section in Division 28.
- C. Section 28 05 13 - CONDUCTORS AND CABLES FOR ELECTRONIC SAFETY AND SECURITY. Requirements for low voltage power and lighting wiring.

**1.3 SUBMITTALS**

- A. Submit in accordance with Section 28 05 00, COMMON WORK RESULTS FOR ELECTRONIC SAFETY AND SECURITY.
- B. Shop Drawings:
  - 1. Clearly present enough information to determine compliance with drawings and specifications.
  - 2. Include the location of system grounding electrode connections and the routing of aboveground and underground grounding electrode conductors.
- C. Test Reports: Provide certified test reports of ground resistance.
- D. Certifications: Two weeks prior to final inspection, submit four copies of the following to the COTR:
  - 1. Certification that the materials and installation are in accordance with the drawings and specifications.
  - 2. Certification by the contractor that the complete installation has been properly installed and tested.

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**1.4 APPLICABLE PUBLICATIONS**

- A. Publications listed below (including amendments, addenda, revisions, supplements, and errata) form a part of this specification to the extent referenced. Publications are referenced in the text by designation only.
- B. American Society for Testing and Materials (ASTM):
  - B1-07 .....Standard Specification for Hard-Drawn Copper Wire
  - B3-07 .....Standard Specification for Soft or Annealed Copper Wire
  - B8-04 .....Standard Specification for Concentric-Lay-Stranded Copper Conductors, Hard, Medium-Hard, or Soft
- C. Institute of Electrical and Electronics Engineers, Inc. (IEEE):
  - 81-1983 .....IEEE Guide for Measuring Earth Resistivity, Ground Impedance, and Earth Surface Potentials of a Ground System
  - C2-07 .....National Electrical Safety Code
- D. National Fire Protection Association (NFPA):
  - 70-11 .....National Electrical Code (NEC)
  - 99-2005 .....Health Care Facilities
- E. Underwriters Laboratories, Inc. (UL):
  - 44-05 .....Thermoset-Insulated Wires and Cables
  - 83-08 .....Thermoplastic-Insulated Wires and Cables
  - 467-07 .....Grounding and Bonding Equipment
  - 486A-486B-03 .....Wire Connectors

**PART 2 - PRODUCTS**

**2.1 GROUNDING AND BONDING CONDUCTORS**

- A. Equipment grounding conductors shall be UL 83 insulated stranded copper, except that sizes 6 mm<sup>2</sup> (10 AWG) and smaller shall be solid copper. Insulation color shall be continuous green for all equipment grounding conductors, except that wire sizes 25 mm<sup>2</sup> (4 AWG) and larger shall be permitted to be identified per NEC.
- B. Bonding conductors shall be ASTM B8 bare stranded copper, except that sizes 6 mm<sup>2</sup> (10 AWG) and smaller shall be ASTM B1 solid bare copper wire.

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**2.2 GROUND RODS**

- A. Copper clad steel, 19 mm (3/4-inch) diameter by 3000 mm (10 feet) long, conforming to UL 467.
- B. Quantity of rods shall be as required to obtain the specified ground resistance.

**2.3 SPLICES AND TERMINATION COMPONENTS**

- A. Components shall meet or exceed UL 467 and be clearly marked with the manufacturer, catalog number, and permitted conductor size(s).2.4 ground connections
- B. Listed and labeled by an NRTL acceptable to authorities having jurisdiction for applications in which used and for specific types, sizes, and combinations of conductors and other items connected.
- C. Below Grade: Exothermic-welded type connectors.
- D. Above Grade:
  - 1. Bonding Jumpers: Compression-type connectors, using zinc-plated fasteners and external tooth lockwashers.
  - 2. Connection to Building Steel: Exothermic-welded type connectors.
  - 3. Ground Busbars: Two-hole compression type lugs, using tin-plated copper or copper alloy bolts and nuts.
  - 4. Rack and Cabinet Ground Bars: One-hole compression-type lugs, using zinc-plated or copper alloy fasteners.
  - 5. Bolted Connectors for Conductors and Pipes: Copper or copper alloy, pressure type with at least two bolts.
    - a) Pipe Connectors: Clamp type, sized for pipe.
  - 6. Welded Connectors: Exothermic-welding kits of types recommended by kit manufacturer for materials being joined and installation conditions.

**2.4 EQUIPMENT RACK AND CABINET GROUND BARS**

- A. Provide solid copper ground bars designed for mounting on the framework of open or cabinet-enclosed equipment racks with minimum dimensions of 4 mm thick by 19 mm wide (3/8 inch x ¾ inch).

**2.5 GROUND TERMINAL BLOCKS**

- A. At any equipment mounting location (e.g., backboards and hinged cover enclosures) where rack-type ground bars cannot be mounted, provide screw lug-type terminal blocks.

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**2.6 SECURITY CONTROL ROOM GROUND**

- A. Provide 50mm<sup>2</sup> (1/0 AWG) stranded copper grounding conductor(s) color coded with a green jacket, bolted at the Room's Communications System Grounding Electrode Cooper Plate and circulate to each equipment rack ground buss bar through the wire management system. Connect each equipment rack, wire management system's cable tray, ladder, etc. to the circulating ground wire with a minimum 25mm<sup>2</sup> (4AWG) stranded Cooper Wire, color coded with a green jacket.
  - 1. Connect each equipment rack ground buss bar to the circulating ground wire as indicated in 2.9.A, and
  - 2. Connect each additional room item to the circulating ground wire as indicated in 2.9.A.

**PART 3 - EXECUTION**

**3.1 GENERAL**

- A. Ground in accordance with the NEC, as shown on drawings, and as specified herein.
- B. System Grounding:
  - 1. Secondary service neutrals: Ground at the supply side of the secondary disconnecting means and at the related transformers.
  - 2. Separately derived systems (transformers downstream from the service entrance): Ground the secondary neutral.
- C. Equipment Grounding: Metallic structures, including ductwork and building steel, enclosures, raceways, junction boxes, outlet boxes, cabinets, machine frames, and other conductive items in close proximity with electrical circuits, shall be bonded and grounded.

**3.2 INACCESSIBLE GROUNDING CONNECTIONS**

- A. Make grounding connections, which are buried or otherwise normally inaccessible (except connections for which periodic testing access is required) by exothermic weld.

**3.3 CORROSION INHIBITORS**

- A. When making ground and ground bonding connections, apply a corrosion inhibitor to all contact surfaces. Use corrosion inhibitor appropriate for protecting a connection between the metals used.

**3.4 CONDUCTIVE PIPING**

- A. Bond all conductive piping systems, interior and exterior, to the building to the grounding electrode system. Bonding connections shall be made as close as practical to the equipment ground bus.



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**3.5 COMPUTER ROOM/SECURITY EQUIPMENT ROOM GROUNDING**

- A. Conduit: Ground and bond metallic conduit systems as follows:
1. Ground metallic service conduit and any pipes entering or being routed within the computer room at each end using 16 mm<sup>2</sup> (6AWG) bonding jumpers.
  2. Bond at all intermediate metallic enclosures and across all joints using 16 mm<sup>2</sup> (6 AWG) bonding jumpers.

**3.6 WIREWAY GROUNDING**

- A. Ground and Bond Metallic Wireway Systems as follows:
1. Bond the metallic structures of wireway to provide 100 percent electrical continuity throughout the wireway system by connecting a 16 mm<sup>2</sup> (6 AWG) bonding jumper at all intermediate metallic enclosures and across all section junctions.
  2. Install insulated 16 mm<sup>2</sup> (6 AWG) bonding jumpers between the wireway system bonded as required in paragraph 1 above, and the closest building ground at each end and approximately every 16 meters (50 feet).
  3. Use insulated 16 mm<sup>2</sup> (6 AWG) bonding jumpers to ground or bond metallic wireway at each end at all intermediate metallic enclosures and cross all section junctions.
  4. Use insulated 16 mm<sup>2</sup> (6 AWG) bonding jumpers to ground cable tray to column-mounted building ground plates (pads) at each end and approximately every 15 meters.

**3.7 GROUND RESISTANCE**

- A. Grounding system resistance to ground shall not exceed 5 ohms. Make any modifications or additions to the grounding electrode system necessary for compliance without additional cost to the Government. Final tests shall ensure that this requirement is met.
- B. Resistance of the grounding electrode system shall be measured using a four-terminal fall-of-potential method as defined in IEEE 81. Ground resistance measurements shall be made before the electrical distribution system is energized and shall be made in normally dry conditions not fewer than 48 hours after the last rainfall. Resistance measurements of separate grounding electrode systems shall be made before the systems are bonded together below grade. The combined resistance of separate systems may be used to meet the required

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resistance, but the specified number of electrodes must still be provided.

- C. Services at power company interface points shall comply with the power company ground resistance requirements.
- D. Below-grade connections shall be visually inspected by the COTR prior to backfilling. The contractor shall notify the COTR 24 hours before the connections are ready for inspection.

**3.8 GROUND ROD INSTALLATION**

- A. Drive each rod vertically in the earth, not less than 3000 mm (10 feet) in depth.
- B. Where permanently concealed ground connections are required, make the connections by the exothermic process to form solid metal joints. Make accessible ground connections with mechanical pressure type ground connectors.
- C. Where rock prevents the driving of vertical ground rods, install angled ground rods or grounding electrodes in horizontal trenches to achieve the specified resistance.

**3.9 GROUNDING FOR RF/EMI CONTROL**

- A. Install bonding jumpers to bond all conduit, cable trays, sleeves and equipment for low voltage signaling and data communications circuits. Bonding jumpers shall consist of 100 mm (4 inches) wide copper strip or two 6 mm<sup>2</sup> (10 AWG) copper conductors spaced minimum 100 mm (4 inches) apart. Use 16 mm<sup>2</sup> (6 AWG) copper where exposed and subject to damage.
- B. Comply with the following when shielded cable is used for data circuits.
  - 1. Shields shall be continuous throughout each circuit.
  - 2. Connect shield drain wires together at each circuit connection point and insulate from ground. Do not ground the shield.
  - 3. Do not connect shields from different circuits together.
  - 4. Shield shall be connected at one end only. Connect shield to signal reference at the origin of the circuit. Consult with equipment manufacturer to determine signal reference.

**3.10 LABELING**

- A. Comply with requirements in Division 26 Section "ELECTRICAL IDENTIFICATION" Article for instruction signs. The label or its text shall be green.

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B. Install labels at the telecommunications bonding conductor and grounding equalizer.

1. Label Text: "If this connector or cable is loose or if it must be removed for any reason, notify the facility manager."

**3.11 FIELD QUALITY CONTROL**

A. Perform tests and inspections.

B. Tests and Inspections:

1. After installing grounding system but before permanent electrical circuits have been energized, test for compliance with requirements.
2. Inspect physical and mechanical condition. Verify tightness of accessible, bolted, electrical connections with a calibrated torque wrench according to manufacturer's written instructions.
3. Test completed grounding system at each location where a maximum ground-resistance level is specified, at service disconnect enclosure grounding terminal at individual ground rods. Make tests at ground rods before any conductors are connected.
  - a. Measure ground resistance no fewer than two full days after last trace of precipitation and without soil being moistened by any means other than natural drainage or seepage and without chemical treatment or other artificial means of reducing natural ground resistance.
  - b. Perform tests by fall-of-potential method according to IEEE 81.

C. Grounding system will be considered defective if it does not pass tests and inspections.

D. Prepare test and inspection reports.

E. Report measured ground resistances that exceed the following values:

1. Power Distribution Units or Panel boards Serving Electronic Equipment: 3 ohm(s).

F. Excessive Ground Resistance: If resistance to ground exceeds specified values, notify Architect promptly and include recommendations to reduce ground resistance.

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SECTION 28 05 28.33  
CONDUITS AND BACKBOXES FOR ELECTRONIC SAFETY AND SECURITY

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This section specifies the finishing, installation, connection, testing certification of the conduit, fittings, and boxes to form a complete, coordinated, raceway system(s). Conduits and when approved separate UL Certified and Listed partitioned telecommunications raceways are required for a fully functional Electronic Safety and Security (ESS) system. Raceways are required for all electronic safety and security cabling unless shown or specified otherwise.
- B. Definitions: The term conduit, as used in this specification, shall mean any or all of the raceway types specified.

1.2 RELATED WORK

- A. Section 01 00 00 - GENERAL REQUIREMENTS. For General Requirements.
- B. Section 06 10 00 - ROUGH CARPENTRY. Requirements for mounting board for communication closets.
- C. Section 07 84 00 - FIRESTOPPING. Requirements for sealing around penetrations to maintain the integrity of fire rated construction.
- D. Section 07 60 00 - FLASHING AND SHEET METAL. Requirements for fabrications for the deflection of water away from the building envelope at penetrations.
- E. Section 07 92 00 - JOINT SEALANTS. Requirements for sealing around conduit penetrations through the building envelope to prevent moisture migration into the building.
- F. Section 09 91 00 - PAINTING. Requirements for identification and painting of conduit and other devices.
- G. Section 28 05 00 - COMMON WORK RESULTS FOR ELECTRONIC SAFETY AND SECURITY. For general electrical requirements, general arrangement of the contract documents, coordination, quality assurance, project conditions, equipment and materials, and items that is common to more than one section of Division 28.
- H. Section 28 05 26 - GROUNDING AND BONDING FOR ELECTRONIC SAFETY AND SECURITY. Requirements for personnel safety and to provide a low impedance path for possible ground fault currents.

1.3 DEFINITIONS

- A. EMT: Electrical metallic tubing.
- B. ENT: Electrical nonmetallic tubing.
- C. EPDM: Ethylene-propylene-diene terpolymer rubber.
- D. FMC: Flexible metal conduit.

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- E. IMC: Intermediate metal conduit.
- F. LFMC: Liquidtight flexible metal conduit.
- G. LFNC: Liquidtight flexible nonmetallic conduit.
- H. NBR: Acrylonitrile-butadiene rubber.
- I. RNC: Rigid nonmetallic conduit.

**1.4 QUALITY ASSURANCE**

- A. Refer to Paragraph 1.4 Quality Assurance, in Section 28 05 00, COMMON WORK RESULTS FOR ELECTRONIC SAFETY AND SECURITY.

**1.5 SUBMITTALS**

- A. Submit in accordance with Section 28 05 00, COMMON WORK RESULTS FOR ELECTRONIC SAFETY AND SECURITY and Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES. Furnish the following:
- B. Shop Drawings:
  - 1. Size and location of main feeders;
  - 2. Size and location of panels and pull boxes
  - 3. Layout of required conduit penetrations through structural elements.
  - 4. The specific item proposed and its area of application shall be identified on the catalog cuts.
- C. Certification: Prior to final inspection, deliver to the Resident Engineer/COTR four copies of the certification that the material is in accordance with the drawings and specifications and has been properly installed.
- D. Completed System Readiness Checklists provided by the Commissioning Agent and completed by the contractor, signed by a qualified technician and dated on the date of completion, in accordance with the requirements of Section 28 08 00 COMMISSIONING OF ELECTRONIC SAFETY AND SECURITY SYSTEMS.
- E. Product Data: For surface raceways, wireways and fittings, floor boxes, hinged-cover enclosures, and cabinets.
- F. Shop Drawings: For the following raceway components. Include plans, elevations, sections, details, and attachments to other work.
  - 1. Custom enclosures and cabinets.
  - 2. Handholes and boxes for underground wiring, including the following:
    - a. Duct entry provisions, including locations and duct sizes.
    - b. Frame and cover design.
    - c. Grounding details.
    - d. Dimensioned locations of cable rack inserts, and pulling-in and lifting irons.
    - e. Joint details.

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- G. Coordination Drawings: Conduit routing plans, drawn to scale, on which the following items are shown and coordinated with each other, based on input from installers of the items involved:
1. Structural members in the paths of conduit groups with common supports.
  2. HVAC and plumbing items and architectural features in the paths of conduit groups with common supports.
- H. Manufacturer Seismic Qualification Certification: Submit certification that enclosures and cabinets and their mounting provisions, including those for internal components, will withstand seismic forces defined in Division 16 Section "Electrical Supports and Seismic Restraints." Include the following:
1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
    - a. The term "withstand" means "the cabinet or enclosure will remain in place without separation of any parts when subjected to the seismic forces specified and the unit will retain its enclosure characteristics, including its interior accessibility, after the seismic event."
  2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
  3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.
- I. Source quality-control test reports.

**1.6 APPLICABLE PUBLICATIONS**

- A. Publications listed below (including amendments, addenda, revisions, supplements and errata) form a part of this specification to the extent referenced. Publications are referenced in the text by the basic designation only.
- B. National Electrical Manufacturers Association (NEMA):
- TC-3-04 .....PVC Fittings for Use with Rigid PVC Conduit and  
Tubing
- FB1-07 .....Fittings, Cast Metal Boxes and Conduit Bodies  
for Conduit, Electrical Metallic Tubing and  
Cable
- C. National Fire Protection Association (NFPA):
- 70-11 .....National Electrical Code (NEC)
- D. Underwriters Laboratories, Inc. (UL):
- 1-05 .....Flexible Metal Conduit
- 5-04 .....Surface Metal Raceway and Fittings

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6-07 .....Rigid Metal Conduit  
50-07 .....Enclosures for Electrical Equipment  
360-09 .....Liquid-Tight Flexible Steel Conduit  
467-07 .....Grounding and Bonding Equipment  
514A-04 .....Metallic Outlet Boxes  
514B-04 .....Fittings for Cable and Conduit  
514C-02 .....Nonmetallic Outlet Boxes, Flush-Device Boxes and  
Covers  
651-05 .....Schedule 40 and 80 Rigid PVC Conduit  
651A-07 .....Type EB and A Rigid PVC Conduit and HDPE Conduit  
797-07 .....Electrical Metallic Tubing  
1242-06 .....Intermediate Metal Conduit

**PART 2 - PRODUCTS**

**2.1 GENERAL**

- A. Conduit Size: In accordance with the NEC, but not less than 20 mm (3/4 inch) unless otherwise shown.

**2.2.CONDUIT**

- A. Rigid galvanized steel: Shall Conform to UL 6, ANSI C80.1.  
B. Rigid aluminum: Shall Conform to UL 6A, ANSI C80.5.  
C. Rigid intermediate steel conduit (IMC): Shall Conform to UL 1242, ANSI C80.6.  
D. Electrical metallic tubing (EMT): Shall Conform to UL 797, ANSI C80.3.  
Maximum size not to exceed 105 mm (4 inches) and shall be permitted only with cable rated 600 volts or less.  
E. Flexible galvanized steel conduit: Shall Conform to UL 1.  
F. Liquid-tight flexible metal conduit: Shall Conform to UL 360.  
G. Direct burial plastic conduit: Shall conform to UL 651 and UL 651A, heavy wall PVC or high density polyethylene (PE).

**2.3.WIREWAYS AND RACEWAYS**

- A. Surface metal raceway: Shall Conform to UL 5.

**2.4.CONDUIT FITTINGS**

- A. Rigid steel and IMC conduit fittings:  
1. Fittings shall meet the requirements of UL 514B and ANSI/ NEMA FB1.  
2. Standard threaded couplings, locknuts, bushings, and elbows: Only steel or malleable iron materials are acceptable. Integral retractable type IMC couplings are also acceptable.  
3. Locknuts: Bonding type with sharp edges for digging into the metal wall of an enclosure.  
4. Bushings: Metallic insulating type, consisting of an insulating insert molded or locked into the metallic body of the fitting.



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- Bushings made entirely of metal or nonmetallic material are not permitted.
5. Erickson (union-type) and set screw type couplings: Approved for use in concrete are permitted for use to complete a conduit run where conduit is installed in concrete. Use set screws of case hardened steel with hex head and cup point to firmly seat in conduit wall for positive ground. Tightening of set screws with pliers is prohibited.
  6. Sealing fittings: Threaded cast iron type. Use continuous drain type sealing fittings to prevent passage of water vapor. In concealed work, install fittings in flush steel boxes with blank cover plates having the same finishes as that of other electrical plates in the room.
- B. Rigid aluminum conduit fittings:
1. Standard threaded couplings, locknuts, bushings, and elbows: Malleable iron, steel or aluminum alloy materials; Zinc or cadmium plate iron or steel fittings. Aluminum fittings containing more than 0.4 percent copper are prohibited.
  2. Locknuts and bushings: As specified for rigid steel and IMC conduit.
  3. Set screw fittings: Not permitted for use with aluminum conduit.
- C. Electrical metallic tubing fittings:
1. Fittings shall meet the requirements of UL 514B and ANSI/ NEMA FB1.
  2. Only steel or malleable iron materials are acceptable.
  3. Couplings and connectors: Concrete tight and rain tight, with connectors having insulated throats. Use gland and ring compression type couplings and connectors for conduit sizes 50 mm (2 inches) and smaller. Use set screw type couplings with four set screws each for conduit sizes over 50 mm (2 inches). Use set screws of case-hardened steel with hex head and cup point to firmly seat in wall of conduit for positive grounding.
  4. Indent type connectors or couplings are prohibited.
  5. Die-cast or pressure-cast zinc-alloy fittings or fittings made of "pot metal" are prohibited.
- D. Flexible steel conduit fittings:
1. Conform to UL 514B. Only steel or malleable iron materials are acceptable.
  2. Clamp type, with insulated throat.
- E. Liquid-tight flexible metal conduit fittings:
1. Fittings shall meet the requirements of UL 514B and ANSI/ NEMA FB1.
  2. Only steel or malleable iron materials are acceptable.

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3. Fittings must incorporate a threaded grounding cone, a steel or plastic compression ring, and a gland for tightening. Connectors shall have insulated throats.
- F. Direct burial plastic conduit fittings:
  1. Fittings shall meet the requirements of UL 514C and NEMA TC3.
  2. As recommended by the conduit manufacturer.
- G. Surface metal raceway fittings: As recommended by the raceway manufacturer.
- H. Expansion and deflection couplings:
  1. Conform to UL 467 and UL 514B.
  2. Accommodate, 19 mm (0.75 inch) deflection, expansion, or contraction in any direction, and allow 30 degree angular deflections.
  3. Include internal flexible metal braid sized to guarantee conduit ground continuity and fault currents in accordance with UL 467, and the NEC code tables for ground conductors.
  4. Jacket: Flexible, corrosion-resistant, watertight, moisture and heat resistant molded rubber material with stainless steel jacket clamps.

**2.5 CONDUIT SUPPORTS**

- A. Parts and hardware: Zinc-coat or provide equivalent corrosion protection.
- B. Individual Conduit Hangers: Designed for the purpose, having a pre-assembled closure bolt and nut, and provisions for receiving a hanger rod.
- C. Multiple conduit (trapeze) hangers: Not less than 38 mm by 38 mm (1-1/2 by 1-1/2 inch), 12 gage steel, cold formed, lipped channels; with not less than 9 mm (3/8 inch) diameter steel hanger rods.
- D. Solid Masonry and Concrete Anchors: Self-drilling expansion shields, or machine bolt expansion.

**2.6 OUTLET, JUNCTION, AND PULL BOXES**

- A. UL-50 and UL-514A.
- B. Cast metal where required by the NEC or shown, and equipped with rustproof boxes.
- C. Nonmetallic Outlet and Device Boxes: NEMA OS 2.
- D. Metal Floor Boxes: Cast or sheet metal, semi-adjustable, rectangular.
- E. Sheet metal boxes: Galvanized steel, except where otherwise shown.
- F. Flush mounted wall or ceiling boxes shall be installed with raised covers so that front face of raised cover is flush with the wall. Surface mounted wall or ceiling boxes shall be installed with surface style flat or raised covers.

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**2.7 CABINETS**

- A. NEMA 250, Type 1, galvanized-steel box with removable interior panel and removable front, finished inside and out with manufacturer's standard enamel.
- B. Hinged door in front cover with flush latch and concealed hinge.
- C. Key latch to match panelboards.
- D. Metal barriers to separate wiring of different systems and voltage.
- E. Accessory feet where required for freestanding equipment.

**2.8 WIREWAYS**

- A. Equip with hinged covers, except where removable covers are shown.

**2.9 SLEEVES FOR RACEWAYS**

- A. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, galvanized steel, plain ends.
- B. Cast-Iron Pipe Sleeves: Cast or fabricated "wall pipe," equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.
- C. Sleeves for Rectangular Openings: Galvanized sheet steel with minimum 0.052- or 0.138-inch (1.3- or 3.5-mm) thickness as indicated and of length to suit application.
- D. Coordinate sleeve selection and application with selection and application of firestopping specified in Division 07 84 00 "FIRESTOPPING."

**2.10 SLEEVE SEALS**

- A. Description: Modular sealing device, designed for field assembly, to fill annular space between sleeve and cable.
  - 1. Sealing Elements: EPDM interlocking links shaped to fit surface of cable or conduit. Include type and number required for material and size of raceway or cable.
  - 2. Pressure Plates: Plastic. Include two for each sealing element.
  - 3. Connecting Bolts and Nuts: Carbon steel with corrosion-resistant coating of length required to secure pressure plates to sealing elements. Include one for each sealing element.

**2.11 GROUT**

- A. Nonmetallic, Shrinkage-Resistant Grout: ASTM C 1107, factory-packaged, nonmetallic aggregate grout, noncorrosive, nonstaining, mixed with water to consistency suitable for application and a 30-minute working time.

**PART 3 - EXECUTION**

**3.1 PENETRATIONS**

- A. Cutting or Holes:

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1. Locate holes in advance where they are proposed in the structural sections such as ribs or beams. Obtain the approval of the Resident Engineer/COTR prior to drilling through structural sections.
  2. Cut holes through concrete and masonry in new and existing structures with a diamond core drill or concrete saw. Pneumatic hammer, impact electric, hand or manual hammer type drills are not allowed, except where permitted by the Resident Engineer/COTR as required by limited working space.
- B. Fire Stop: Where conduits, wireways, and other electronic safety and security raceways pass through fire partitions, fire walls, smoke partitions, or floors, install a fire stop that provides an effective barrier against the spread of fire, smoke and gases as specified in Section 07 84 00, FIRESTOPPING, with rock wool fiber or silicone foam sealant only. Completely fill and seal clearances between raceways and openings with the fire stop material.
- C. Waterproofing: At floor, exterior wall, and roof conduit penetrations, completely seal clearances around the conduit and make watertight as specified in Section 07 92 00, "JOINT SEALANTS".

**3.2 INSTALLATION, GENERAL**

- A. Install conduit as follows:
1. In complete runs before pulling in cables or wires.
  2. Flattened, dented, or deformed conduit is not permitted. Remove and replace the damaged conduits with new undamaged material.
  3. Assure conduit installation does not encroach into the ceiling height head room, walkways, or doorways.
  4. Cut square with a hacksaw, ream, remove burrs, and draw up tight.
  5. Mechanically continuous.
  6. Independently support conduit at 2.4 m (8 foot) on center. Do not use other supports i.e., (suspended ceilings, suspended ceiling supporting members, lighting fixtures, conduits, mechanical piping, or mechanical ducts).
  7. Support within 300 mm (12 inches) of changes of direction, and within 300 mm (12 inches) of each enclosure to which connected.
  8. Close ends of empty conduit with plugs or caps at the rough-in stage to prevent entry of debris, until wires are pulled in.
  9. Conduit installations under fume and vent hoods are prohibited.
  10. Secure conduits to cabinets, junction boxes, pull boxes and outlet boxes with bonding type locknuts. For rigid and IMC conduit installations, provide a locknut on the inside of the enclosure, made

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up wrench tight. Do not make conduit connections to junction box covers.

12. Do not use aluminum conduits in wet locations.
13. Unless otherwise indicated on the drawings or specified herein, all conduits shall be installed concealed within finished walls, floors and ceilings.

**B. Conduit Bends:**

1. Make bends with standard conduit bending machines.
2. Conduit hickey may be used for slight offsets, and for straightening stubbed out conduits.
3. Bending of conduits with a pipe tee or vise is prohibited.

**C. Layout and Homeruns:**

1. Install conduit with wiring, including homeruns, as shown.
2. Deviations: Make only where necessary to avoid interferences and only after drawings showing the proposed deviations have been submitted approved by the Resident Engineer/COTR.

**3.3 CONCEALED WORK INSTALLATION**

**A. In Concrete:**

1. Conduit: Rigid steel, IMC or EMT. Do not install EMT in concrete slabs that are in contact with soil, gravel or vapor barriers.
2. Align and run conduit in direct lines.
3. Install conduit through concrete beams only when the following occurs:
  - a. Where shown on the structural drawings.
  - b. As approved by the Resident Engineer/COTR prior to construction, and after submittal of drawing showing location, size, and position of each penetration.
4. Installation of conduit in concrete that is less than 75 mm (3 inch) thick is prohibited.
  - a. Conduit outside diameter larger than 1/3 of the slab thickness is prohibited.
  - b. Space between conduits in slabs: Approximately six conduit diameters apart, except one conduit diameter at conduit crossings.
  - c. Install conduits approximately in the center of the slab so that there will be a minimum of 19 mm (3/4 inch) of concrete around the conduits.
5. Make couplings and connections watertight. Use thread compounds that are UL approved conductive type to insure low resistance ground continuity through the conduits. Tightening set screws with pliers is prohibited.

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- B. Furred or Suspended Ceilings and in Walls:
  - 1. Conduit for conductors above 600 volts:
    - a. Rigid steel or rigid aluminum.
    - b. Aluminum conduit mixed indiscriminately with other types in the same system is prohibited.
  - 2. Conduit for conductors 600 volts and below:
    - a. Rigid steel, IMC, rigid aluminum, or EMT. Different type conduits mixed indiscriminately in the same system is prohibited.
  - 3. Align and run conduit parallel or perpendicular to the building lines.
  - 4. Tightening set screws with pliers is prohibited.

**3.4 EXPOSED WORK INSTALLATION**

- A. Unless otherwise indicated on the drawings, exposed conduit is only permitted in mechanical and electrical rooms.
- B. Conduit for Conductors 600 volts and below:
  - 1. Rigid steel, IMC, rigid aluminum, or EMT. Different type of conduits mixed indiscriminately in the system is prohibited.
- C. Align and run conduit parallel or perpendicular to the building lines.
- D. Install horizontal runs close to the ceiling or beams and secure with conduit straps.
- E. Support horizontal or vertical runs at not over 2400 mm (eight foot) intervals.
- F. Surface metal raceways: Use only where shown.
- G. Painting:
  - 1. Paint exposed conduit as specified in Section 09 91 00, "PAINTING".
  - 2. Paint all conduits containing cables rated over 600 volts safety orange. Refer to Section 09 91 00, "PAINTING" for preparation, paint type, and exact color. In addition, paint legends, using 50 mm (two inch) high black numerals and letters, showing the cable voltage rating. Provide legends where conduits pass through walls and floors and at maximum 6000 mm (20 foot) intervals in between.

**3.5 EXPANSION JOINTS**

- A. Conduits 75 mm (3 inches) and larger, that are secured to the building structure on opposite sides of a building expansion joint, require expansion and deflection couplings. Install the couplings in accordance with the manufacturer's recommendations.
- B. Provide conduits smaller than 75 mm (3 inches) with junction boxes on both sides of the expansion joint. Connect conduits to junction boxes with sufficient slack of flexible conduit to produce 125 mm (5 inch) vertical drop midway between the ends. Flexible conduit shall have a

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copper green ground bonding jumper installed. In lieu of this flexible conduit, expansion and deflection couplings as specified above for 375 mm (15 inches) and larger conduits are acceptable.

- C. Install expansion and deflection couplings where shown.
- D. Seismic Areas: In seismic areas, provide conduits rigidly secured to the building structure on opposite sides of a building expansion joint with junction boxes on both sides of the joint. Connect conduits to junction boxes with 375 mm (15 inches) of slack flexible conduit. Flexible conduit shall have a copper green ground bonding jumper installed.

**3.6 CONDUIT SUPPORTS, INSTALLATION**

- A. Safe working load shall not exceed 1/4 of proof test load of fastening devices.
- B. Use pipe straps or individual conduit hangers for supporting individual conduits. Maximum distance between supports is 2.5 m (8 foot) on center.
- C. Support multiple conduit runs with trapeze hangers. Use trapeze hangers that are designed to support a load equal to or greater than the sum of the weights of the conduits, wires, hanger itself, and 90 kg (200 pounds). Attach each conduit with U-bolts or other approved fasteners.
- D. Support conduit independently of junction boxes, pull boxes, fixtures, suspended ceiling T-bars, angle supports, and similar items.
- E. Fasteners and Supports in Solid Masonry and Concrete:
  - 1. New Construction: Use steel or malleable iron concrete inserts set in place prior to placing the concrete.
  - 2. Existing Construction:
    - a. Steel expansion anchors not less than 6 mm (1/4 inch) bolt size and not less than 28 mm (1-1/8 inch) embedment.
    - b. Power set fasteners not less than 6 mm (1/4 inch) diameter with depth of penetration not less than 75 mm (3 inches).
    - c. Use vibration and shock resistant anchors and fasteners for attaching to concrete ceilings.
- F. Hollow Masonry: Toggle bolts are permitted.
- G. Bolts supported only by plaster or gypsum wallboard are not acceptable.
- H. Metal Structures: Use machine screw fasteners or other devices specifically designed and approved for the application.
- I. Attachment by wood plugs, rawl plug, plastic, lead or soft metal anchors, or wood blocking and bolts supported only by plaster is prohibited.
- J. Chain, wire, or perforated strap shall not be used to support or fasten conduit.

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- K. Spring steel type supports or fasteners are prohibited for all uses except: Horizontal and vertical supports/fasteners within walls.
- L. Vertical Supports: Vertical conduit runs shall have riser clamps and supports in accordance with the NEC and as shown. Provide supports for cable and wire with fittings that include internal wedges and retaining collars.

**3.7 BOX INSTALLATION**

- A. Boxes for Concealed Conduits:
  - 1. Flush mounted.
  - 2. Provide raised covers for boxes to suit the wall or ceiling, construction and finish.
- B. In addition to boxes shown, install additional boxes where needed to prevent damage to cables and wires during pulling in operations.
- C. Remove only knockouts as required and plug unused openings. Use threaded plugs for cast metal boxes and snap-in metal covers for sheet metal boxes.
- D. Outlet boxes in the same wall mounted back-to-back are prohibited. A minimum 600 mm (24 inch), center-to-center lateral spacing shall be maintained between boxes).
- E. Minimum size of outlet boxes for ground fault interrupter (GFI) receptacles is 100 mm (4 inches) square by 55 mm (2-1/8 inches) deep, with device covers for the wall material and thickness involved.
- F. Stencil or install phenolic nameplates on covers of the boxes identified on riser diagrams; for example "SIG-FA JB No. 1".
- G. On all Branch Circuit junction box covers, identify the circuits with black marker.

**3.8 ELECTRONIC SAFETY AND SECURITY CONDUIT**

- A. Install the electronic safety and security raceway system as shown on drawings.
- B. Minimum conduit size of 19 mm (3/4 inch), but not less than the size shown on the drawings.
- C. All conduit ends shall be equipped with insulated bushings.
- D. All 100 mm (four inch) conduits within buildings shall include pull boxes after every two 90 degree bends. Size boxes per the NEC.
- E. Vertical conduits/sleeves through closets floors shall terminate not less than 75 mm (3 inches) below the floor and not less than 75 mm (3 inches) below the ceiling of the floor below.
- F. Terminate conduit runs to/from a backboard in a closet or interstitial space at the top or bottom of the backboard. Conduits shall enter communication closets next to the wall and be flush with the backboard.



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- G. Where drilling is necessary for vertical conduits, locate holes so as not to affect structural sections such as ribs or beams.
- H. All empty conduits located in communications closets or on backboards shall be sealed with a standard non-hardening duct seal compound to prevent the entrance of moisture and gases and to meet fire resistance requirements.
- I. Conduit runs shall contain no more than four quarter turns (90 degree bends) between pull boxes/backboards. Minimum radius of communication conduit bends shall be as follows (special long radius):

Sizes of Conduit Trade Size	Radius of Conduit Bends mm, Inches
3/4	150 (6)
1	230 (9)
1-1/4	350 (14)
1-1/2	430 (17)
2	525 (21)
2-1/2	635 (25)
3	775 (31)
3-1/2	900 (36)
4	1125 (45)

- J. Furnish and install 19 mm (3/4 inch) thick fire retardant plywood specified in on the wall of communication closets where shown on drawings . Mount the plywood with the bottom edge 300 mm (one foot) above the finished floor.
- K. Furnish and pull wire in all empty conduits. (Sleeves through floor are exceptions).

- - - E N D - - -

SECTION 28 13 00  
PHYSICAL ACCESS CONTROL SYSTEM

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This section specifies the finishing, installation, connection, testing and certification of a complete and fully operating Physical Access Control System, hereinafter referred to as the PACS.
- B. This Section includes a Physical Access Control System consisting of a system server, operating system and application software, and field-installed Controllers connected by a high-speed electronic data transmission network. The PACS shall have the following:
  - 1. Physical Access Control:
    - a. Regulating access through doors
    - b. Anti-passback
    - c. Surge and tamper protection
    - d. Secondary alarm annunciator
    - e. Credential cards and readers
    - f. Push-button switches
    - g. RS-232 ASCII interface
    - h. Monitoring of field-installed devices
    - i. Reporting
  - 2. Security:
    - a. Video and camera control.
- C. System Architecture:
  - 1. Criticality, operational requirements, and/or limiting points of failure may dictate the development of an enterprise and regional server architecture as opposed to system capacity. Provide server and workstation configurations with all necessary connectors, interfaces and accessories as shown.
- D. PACS shall provide secure and reliable identification of Federal employees and contractors by utilizing credential authentication per FIPS-201.
- E. Physical Access Control System (PACS) shall consist of:
  - 1. Head-End equipment server.
  - 2. One or more networked PC-based workstations.
  - 3. Physical Access Control System and Database Management Software.
  - 4. Credential validation software/hardware.

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5. Field installed controllers.
  6. PIV Middleware.
  7. Card readers.
  8. PIV cards.
  9. Supportive information system.
  10. Door locks and sensors.
  11. Power supplies.
  12. Interfaces with:
    - a. Video Surveillance and Assessment System.
    - b. Building Management System.
- F. Head-End equipment server, workstations and controllers shall be connected by a high-speed electronic data transmission network.
- G. Information system supporting PACS , Head-End equipment server, workstations, network switches, routers and controllers shall comply with FIPS 200 requirements (Minimum Security Requirements for Federal Information and Information Systems) and NIST Special Publication 800-53 (Recommended Security Controls for Federal Information Systems).
- H. PACS system shall support:
1. Multiple credential authentication modes.
  2. Bidirectional communication with the reader.
  3. Incident response policy implementation capability; system shall have capability to automatically change access privileges for certain user groups to high security areas in case of incident/emergency.
  4. Visitor management.
- I. All security relevant decisions shall be made on "secure side of the door". Secure side processing shall include;
1. Challenge/response management.
  2. PKI path discovery and validation.
  3. Credential identifier processing.
  4. Authorization decisions.
- J. For locations where secure side processing is not applicable the tamper switches and certified cryptographic processing shall be provided per FIPS-140-2.
- K. System Software: Based on HIRSCH central-station, workstation operating system, server operating system, and application software.

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- L. Software and controllers shall be capable of matching full 56 bit FASC-N plus minimum of 32 bits of public key certificate data.
- M. Software shall have the following capabilities:
  - 1. Multiuser multitasking to allow for independent activities and monitoring to occur simultaneously at different workstations.
  - 2. Support authentication and enrolment:
    - a. PIV verification.
    - b. Expiration date check.
    - c. Digital photo display/check.
    - d. Validate digital signatures of data objects (Objects are signed by the Trusted Authority.
    - e. Private key challenge (CAK & PAK to verify private key public key pairs exist and card is not a clone).
  - 3. Support CRL validation via OCSP or SCVP on a scheduled basis and automatically deny access to any revoked credential in the system.
  - 4. Graphical user interface to show pull-down menus and a menu tree format that complies with interface guidelines of Microsoft Windows operating system.
  - 5. System license shall be for the entire system and shall include capability for future additions that are within the indicated system size limits specified in this Section.
  - 6. System shall have open architecture that allows importing and exporting of data and interfacing with other systems that are compatible with existing operating system.
  - 7. Operator login and access shall be utilized via integrated smart card reader and password protection.
- N. Systems Networks:
  - 1. A standalone system network shall interconnect all components of the system. This network shall include communications between a central station and any peer or subordinate workstations, enrollment stations, local annunciation stations, portal control stations or redundant central stations.
- O. Security Management System Server Redundancy:
  - 1. The SMS shall support multiple levels of fault tolerance and SMS redundancy listed and described below:
    - a. Hot Standby Servers
    - b. Clustering

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- c. Disk Mirroring
  - d. RAID Level 10
  - e. Distributed Intelligence
- P. Number of points:
- 1. PACS shall support multiple autonomous regional servers that can connect to a master command and controller server.
  - 2. Unlimited number of access control readers, unlimited number of inputs or outputs, unlimited number of client workstations, unlimited number of cardholders.
  - 3. Total system solution to enable enterprise-wide, networked, multi-user access to all system resources via a wide range of options for connectivity with the customer's existing LAN and WAN.
- Q. Network(s) connecting PCs and Controllers shall comply with NIST Special Publication 800-53 (Recommended Security Controls for Federal Information Systems) and consist of one or more of the following:
- 1. Local area, IEEE 802.3 Fast Ethernet 100 BASE-TX, star topology network based on TCP/IP.
  - 2. Direct-connected, RS-232 cable from the COM port of the Central Station to the first Controller, then RS-485 to interconnect the remainder of the Controllers at that Location.

**1.2 RELATED WORK**

- A. Section 01 00 00 - GENERAL REQUIREMENTS. For General Requirements.
- B. Section 07 84 00 - FIRESTOPPING. Requirements for firestopping application and use.
- C. Section 08 71 00 - DOOR HARDWARE. Requirements for door installation.
- D. Section 10 14 00 - SIGNAGE. Requirements for labeling and signs.
- E. Section 26 05 11 - REQUIREMENTS FOR ELECTRICAL INSTALLATIONS. Requirements for connection of high voltage.
- F. Section 26 05 21 - LOW VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES (600 VOLTS AND BELOW). Requirements for power cables.
- G. Section 26 05 33 - RACEWAYS AND BOXES FOR ELECTRICAL SYSTEMS. Requirements for infrastructure.
- H. Section 28 05 00 - COMMON WORK RESULTS FOR ELECTRONIC SAFETY AND SECURITY. For general requirements that are common to more than one section in Division 28.
- I. Section 28 05 13 - CONDUCTORS AND CABLES FOR ELECTRONIC SAFETY AND SECURITY. Requirements for conductors and cables.

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- J. Section 28 05 26 - GROUNDING AND BONDING FOR ELECTRONIC SAFETY AND SECURITY. Requirements for grounding of equipment.
- K. Section 28 05 28.33 - CONDUITS AND BOXES FOR ELECTRONIC SAFETY AND SECURITY. Requirements for infrastructure.
- L. Section 28 23 00 - VIDEO SURVEILLANCE. Requirements for security camera systems.
- M. Section 28 26 00 - ELECTRONIC PERSONAL PROTECTION SYSTEM (EPPS). Requirements for emergency and interior communications.

**1.3 QUALITY ASSURANCE**

- A. The Contractor shall be responsible for providing, installing, and the operation of the PACS as shown. The Contractor shall also provide certification as required.
- B. The security system will be installed and tested to ensure all components are fully compatible as a system and can be integrated with all associated security subsystems, whether the security system is stand-alone or a part of a complete Information Technology (IT) computer network.
- C. Manufacturers Qualifications: The manufacturer shall regularly and presently produce, as one of the manufacturer's principal products, the equipment and material specified for this project, and shall have manufactured the item for at least three years.
- D. Product Qualifications:
  - 1. Manufacturer's product shall have been in satisfactory operation, on three installations of similar size and type as this project, for approximately three years.
  - 2. The Government reserves the right to require the Contractor to submit a list of installations where the products have been in operation before approval.
- E. Contractor Qualifications:
  - 1. The Contractor or security sub-contractor shall be a licensed security Contractor with a minimum of five (5) years experience installing and servicing systems of similar scope and complexity. The Contractor shall be an authorized regional representative of the Security Management System's (PACS) manufacturer. The Contractor shall provide four (4) current references from clients with systems of similar scope and complexity which became operational in the past three (3) years. At least three (3) of the references shall be

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- utilizing the same system components, in a similar configuration as the proposed system. The references must include a current point of contact, company or agency name, address, telephone number, complete system description, date of completion, and approximate cost of the project. The Resident Engineer reserves the option to visit the reference sites, with the site Resident Engineer's permission and representative, to verify the quality of installation and the references' level of satisfaction with the system. The Contractor shall provide copies of system manufacturer certification for all technicians. The Contractor shall only utilize factory-trained technicians to install, program, and service the PACS. The Contractor shall only utilize factory-trained technicians to install, terminate and service controller/field panels and reader modules. The technicians shall have a minimum of five (5) continuous years of technical experience in electronic security systems. The Contractor shall have a local service facility. The facility shall be located within 60 miles of the project site. The local facility shall include sufficient spare parts inventory to support the service requirements associated with this contract. The facility shall also include appropriate diagnostic equipment to perform diagnostic procedures. The Resident Engineer reserves the option of surveying the company's facility to verify the service inventory and presence of a local service organization.
- a. The Contractor shall provide proof project superintendent with BICSI Certified Commercial Installer Level 1, Level 2, or Technician to provide oversight of the project.
  - b. Cable installer must have on staff a Registered Communication Distribution Designer (RCDD) certified by Building Industry Consulting Service International. The staff member shall provide consistent oversight of the project cabling throughout design, layout, installation, termination and testing.
- F. Service Qualifications: There shall be a permanent service organization maintained or trained by the manufacturer which will render satisfactory service to this installation within four hours of receipt of notification that service is needed. Submit name and address of service organizations.

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**1.4 SUBMITTALS**

- A. Submit below items in conjunction with Master Specification Sections 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES, Section 02 41 00, DEMOLITION, and Section 28 05 00 COMMON WORK RESULTS FOR ELECTRONIC SAFETY AND SECURITY.
- B. Provide certificates of compliance with Section 1.3, Quality Assurance.
- C. Provide a complete and thorough pre-installation and as-built design package in both electronic format and on paper, minimum size 48 x 48 inches (1220 x 1220 millimeters); drawing submittals shall be per the established project schedule.
- D. Shop drawing and as-built packages shall include, but not be limited to:
  - 1. Index Sheet that shall:
    - a. Define each page of the design package to include facility name, building name, floor, and sheet number.
    - b. Provide a complete list of all security abbreviations and symbols.
    - c. Reference all general notes that are utilized within the design package.
    - d. Specification and scope of work pages for all individual security systems that are applicable to the design package that will:
      - 1) Outline all general and job specific work required within the design package.
      - 2) Provide a detailed device identification table outlining device Identification (ID) and use for all security systems equipment utilized in the design package.
  - 2. Drawing sheets that will be plotted on the individual floor plans or site plans shall:
    - a. Include a title block as defined above.
    - b. Clearly define the drawings scale in both standard and metric measurements.
    - c. Provide device identification and location.
    - d. Address all signal and power conduit runs and sizes that are associated with the design of the electronic security system and other security elements (e.g., barriers, etc.).
    - e. Identify all pull box and conduit locations, sizes, and fill capacities.



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- f. Address all general and drawing specific notes for a particular drawing sheet.
- 3. A detailed riser drawing for each applicable security subsystem shall:
  - a. Indicate the sequence of operation.
  - b. Relationship of integrated components on one diagram.
  - c. Include the number, size, identification, and maximum lengths of interconnecting wires.
  - d. Wire/cable types shall be defined by a wire and cable schedule. The schedule shall utilize a lettering system that will correspond to the wire/cable it represents (example: A = 18 AWG/1 Pair Twisted, Unshielded). This schedule shall also provide the manufacturer's name and part number for the wire/cable being installed.
- 4. A detailed system drawing for each applicable security system shall:
  - a. Clearly identify how all equipment within the system, from main panel to device, shall be laid out and connected.
  - b. Provide full detail of all system components wiring from point-to-point.
  - c. Identify wire types utilized for connection, interconnection with associate security subsystems.
  - d. Show device locations that correspond to the floor plans.
  - e. All general and drawing specific notes shall be included with the system drawings.
- 5. A detailed schedule for all of the applicable security subsystems shall be included. All schedules shall provide the following information:
  - a. Device ID.
  - b. Device Location (e.g. site, building, floor, room number, location, and description).
  - c. Mounting type (e.g. flush, wall, surface, etc.).
  - d. Power supply or circuit breaker and power panel number.
  - e. In addition, for the PACS, provide the door ID, door type (e.g. wood or metal), locking mechanism (e.g. strike or electromagnetic lock) and control device (e.g. card reader or biometrics).
- 6. Detail and elevation drawings for all devices that define how they were installed and mounted.

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- E. Pre-installation design packages shall go through a full review process conducted by the Contractor along with a VA representative to ensure all work has been clearly defined and completed. All reviews shall be conducted in accordance with the project schedule. There shall be four (4) stages to the review process:
1. 35 percent
  2. 65 percent
  3. 90 percent
  4. 100 percent
- F. Provide manufacturer security system product cut-sheets. Submit for approval at least 30 days prior to commencement of formal testing, a Security System Operational Test Plan. Include procedures for operational testing of each component and security subsystem, to include performance of an integrated system test.
- G. Submit manufacture's certification of Underwriters Laboratories, Inc. (UL) listing as specified. Provide all maintenance and operating manuals per Section 01 00 00, GENERAL REQUIREMENTS, and Section 28 05 00 COMMON WORK RESULTS FOR ELECTRONIC SAFETY AND SECURITY.
- H. Completed System Readiness Checklists provided by the Commissioning Agent and completed by the contractor, signed by a qualified technician and dated on the date of completion, in accordance with the requirements of Section 28 08 00 COMMISSIONING OF ELECTRONIC SAFETY AND SECURITY SYSTEMS.
- I. General: Submittals shall be in full compliance of the Contract Documents. All submittals shall be provided in accordance with this section. Submittals lacking the breath or depth these requirements will be considered incomplete and rejected. Submissions are considered multidisciplinary and shall require coordination with applicable divisions to provide a complete and comprehensive submission package. Additional general provisions are as follows:
1. The Contractor shall schedule submittals in order to maintain the project schedule. For coordination drawings refer to Specification Section 01 33 10 - DESIGN SUBMITTAL PROCEDURES, which outline basic submittal requirements and coordination. Section 01 33 10 shall be used in conjunction with this section.
  2. The Contractor shall identify variations from requirements of Contract Documents and state product and system limitations, which

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- may be detrimental to successful performance of the completed work or system.
3. Each package shall be submitted at one (1) time for each review and include components from applicable disciplines (e.g., electrical work, architectural finishes, door hardware, etc.) which are required to produce an accurate and detailed depiction of the project.
  4. Manufacturer's information used for submittal shall have pages with items for approval tagged, items on pages shall be identified, and capacities and performance parameters for review shall be clearly marked through use of an arrow or highlighting. Provide space for Resident Engineer and Contractor review stamps.
  5. Technical Data Drawings shall be in the latest version of AutoCAD®, drawn accurately, and in accordance with VA CAD Standards. FREEHAND SKETCHES OR COPIED VERSIONS OF THE CONSTRUCTION DOCUMENTS WILL NOT BE ACCEPTED. The Contractor shall not reproduce Contract Documents or copy standard information as the basis of the Technical Data Drawings. If departures from the technical data drawings are subsequently deemed necessary by the Contractor, details of such departures and the reasons thereof shall be submitted in writing to the Resident Engineer for approval before the initiation of work.
  6. Packaging: The Contractor shall organize the submissions according to the following packaging requirements.
    - a. Binders: For each manual, provide heavy duty, commercial quality, durable three (3) ring vinyl covered loose leaf binders, sized to receive 8.5 x 11 in paper, and appropriate capacity to accommodate the contents. Provide a clear plastic sleeve on the spine to hold labels describing the contents. Provide pockets in the covers to receive folded sheets.
      - 1) Where two (2) or more binders are necessary to accommodate data, correlate data in each binder into related groupings according to the Project Manual table of contents. Cross-referencing other binders where necessary to provide essential information for communication of proper operation and or maintenance of the component or system.

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- 2) Identify each binder on the front and spine with printed binder title, Project title or name, and subject matter covered. Indicate the volume number if applicable.
- b. Dividers: Provide heavy paper dividers with celluloid tabs for each Section. Mark each tab to indicate contents.
- c. Protective Plastic Jackets: Provide protective transparent plastic jackets designed to enclose diagnostic software for computerized electronic equipment.
- d. Text Material: Where written material is required as part of the manual use the manufacturer's standard printed material, or if not available, specially prepared data, neatly typewritten on 8.5 inches by 11 inches 20 pound white bond paper.
- e. Drawings: Where drawings and/or diagrams are required as part of the manual, provide reinforced punched binder tabs on the drawings and bind them with the text.
  - 1) Where oversized drawings are necessary, fold the drawings to the same size as the text pages and use as a foldout.
  - 2) If drawings are too large to be used practically as a foldout, place the drawing, neatly folded, in the front or rear pocket of the binder. Insert a type written page indicating the drawing title, description of contents and drawing location at the appropriate location of the manual.
  - 3) Drawings shall be sized to ensure details and text is of legible size. Text shall be no less than 1/16" tall.
- f. Manual Content: In each manual include information specified in the individual Specification section, and the following information for each major component of building equipment and controls:
  - 1) General system or equipment description.
  - 2) Design factors and assumptions.
  - 3) Copies of applicable Shop Drawings and Product Data.
  - 4) System or equipment identification including: manufacturer, model and serial numbers of each component, operating instructions, emergency instructions, wiring diagrams, inspection and test procedures, maintenance procedures and schedules, precautions against improper use and maintenance,

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repair instructions, sources of required maintenance materials and related services, and a manual index.

- g. Binder Organization: Organize each manual into separate sections for each piece of related equipment. At a minimum, each manual shall contain a title page, table of contents, copies of Product Data supplemented by drawings and written text, and copies of each warranty, bond, certifications, and service Contract issued. Refer to Group I through V Technical Data Package Submittal requirements for required section content.
- h. Title Page: Provide a title page as the first sheet of each manual to include the following information; project name and address, subject matter covered by the manual, name and address of the Project, date of the submittal, name, address, and telephone number of the Contractor, and cross references to related systems in other operating and/or maintenance manuals.
- i. Table of Contents: After the title page, include a type written table of contents for each volume, arranged systematically according to the Project Manual format. Provide a list of each product included, identified by product name or other appropriate identifying symbols and indexed to the content of the volume. Where more than one (1) volume is required to hold data for a particular system, provide a comprehensive table of contents for all volumes in each volume of the set.
- j. General Information Section: Provide a general information section immediately following the table of contents, listing each product included in the manual, identified by product name. Under each product, list the name, address, and telephone number of the installer and maintenance Contractor. In addition, list a local source for replacement parts and equipment.
- k. Drawings: Provide specially prepared drawings where necessary to supplement the manufacturers printed data to illustrate the relationship between components of equipment or systems, or provide control or flow diagrams. Coordinate these drawings with information contained in Project Record Drawings to assure correct illustration of the completed installation.
- l. Manufacturer's Data: Where manufacturer's standard printed data is included in the manuals, include only those sheets that are

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pertinent to the part or product installed. Mark each sheet to identify each part or product included in the installation.

Where more than one (1) item in tabular format is included, identify each item, using appropriate references from the Contract Documents. Identify data that is applicable to the installation and delete references to information which is not applicable.

- m. Where manufacturer's standard printed data is not available and the information is necessary for proper operation and maintenance of equipment or systems, or it is necessary to provide additional information to supplement the data included in the manual, prepare written text to provide the necessary information. Organize the text in a consistent format under a separate heading for different procedures. Where necessary, provide a logical sequence of instruction for each operating or maintenance procedure. Where similar or more than one product is listed on the submittal the Contractor shall differentiate by highlighting the specific product to be utilized.
  - n. Calculations: Provide a section for circuit and panel calculations.
  - o. Loading Sheets: Provide a section for DGP Loading Sheets.
  - p. Certifications: Provide section for Contractor's manufacturer certifications.
7. Contractor Review: Review submittals prior to transmittal. Determine and verify field measurements and field construction criteria. Verify manufacturer's catalog numbers and conformance of submittal with requirements of contract documents. Return non-conforming or incomplete submittals with requirements of the work and contract documents. Apply Contractor's stamp with signature certifying the review and verification of products occurred, and the field dimensions, adjacent construction, and coordination of information is in accordance with the requirements of the contract documents.
8. Resubmission: Revise and resubmit submittals as required within 15 calendar days of return of submittal. Make resubmissions under procedures specified for initial submittals. Identify all changes made since previous submittal.

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9. Product Data: Within 15 calendar days after execution of the contract, the Contractor shall submit for approval a complete list of all of major products proposed for use. The data shall include name of manufacturer, trade name, model number, the associated contract document section number, paragraph number, and the referenced standards for each listed product.

J. Group 1 Technical Data Package: Group I Technical Data Package shall be one submittal consisting of the following content and organization. Refer to VA Special Conditions Document for drawing format and content requirements. The data package shall include the following:

1. Section I - Drawings:

- a. General - Drawings shall conform to VA Special Conditions and CAD Standards Documents. All text associated with security details shall be 1/8" tall and meet VA text standard for AutoCAD™ drawings.
- b. Cover Sheet - Cover sheet shall consist of Project Title and Address, Project Number, Area and Vicinity Maps.
- c. General Information Sheets - General Information Sheets shall consist of General Notes, Abbreviations, Symbols, Wire and Cable Schedule, Project Phasing, and Sheet Index.
- d. Floor Plans - Floor plans shall be produced from the Architectural backgrounds issued in the Construction Documents. The contractor shall receive floor plans from the prime A/E to develop these drawing sets. Security devices shall be placed on drawings in scale. All text associated with security details shall be 1/8" tall and meet VA text standard for AutoCAD™ drawings. Floor plans shall identify the following:
  - 1) Security devices by symbol.
  - 2) The associated device point number (derived from the loading sheets).
  - 3) Wire and cable types and counts.
  - 4) Conduit sizing and routing.
  - 5) Conduit riser systems.
  - 6) Device and area detail call outs.
- e. Architectural details - Architectural details shall be produced for each device mounting type (door details for doors with

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physical access control, reader pedestals and mounts, security panel and power supply details).

- f. Riser Diagrams - Contractor shall provide a riser diagram indicating riser architecture and distribution of the physical access control system throughout the facility (or area in scope).
- g. Block Diagrams - Contractor shall provide a block diagram for the entire system architecture and interconnections with SMS subsystems. Block diagram shall identify SMS subsystem (e.g., physical access control, intrusion detection, closed circuit television, intercom, and other associated subsystems) integration; and data transmission and media conversion methodologies.
- h. Interconnection Diagrams - Contractor shall provide interconnection diagram for each sensor, and device component. Interconnection diagram shall identify termination locations, standard wire detail to include termination schedule. Diagram shall also identify interfaces to other systems such as elevator control, fire alarm systems, and security management systems.
- i. Security Details:
  - 1) Panel Assembly Detail - For each panel assembly, a panel assembly details shall be provided identifying individual panel component size and content.
  - 2) Panel Details - Provide security panel details identify general arrangement of the security system components, backboard size, wire through size and location, and power circuit requirements.
  - 3) Device Mounting Details - Provide mounting detailed drawing for each security device (physical access control system, intrusion detection, video surveillance and assessment, and intercom systems) for each type of wall and ceiling configuration in project. Device details shall include device, mounting detail, wiring and conduit routing.
  - 4) Details of connections to power supplies and grounding
  - 5) Details of surge protection device installation
  - 6) Sensor detection patterns - Each system sensor shall have associated detection patterns.



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- 7) Equipment Rack Detail - For each equipment rack, provide a scaled detail of the equipment rack location and rack space utilization. Use of BISCII wire management standards shall be employed to identify wire management methodology. Transitions between equipment racks shall be shown to include use vertical and horizontal latter rack system.
- 8) Security Control Room - The contractor shall provide a layout plan for the Security Control Room. The layout plan shall identify all equipment and details associated with the installation.
- 9) Operator Console - The contractor shall provide a layout plan for the Operator Console. The layout plan shall identify all equipment and details associated with the installation.  
Equipment room - the contractor shall provide a layout plan for the equipment room. The layout plan shall identify all equipment and details associated with the installation.
- 10) Equipment Room - Equipment room details shall provide architectural, electrical, mechanical, plumbing, IT/Data and associated equipment and device placements both vertical and horizontally.
- j. Electrical Panel Schedule - Electrical Panel Details shall be provided for all SMS systems electrical power circuits. Panel details shall be provided identifying panel type (Standard, Emergency Power, Emergency/Uninterrupted Power Source, and Uninterrupted Power Source Only), panel location, circuit number, and circuit amperage rating.
- k. Door Schedule - A door schedule shall be developed for each door equipped with electronic security components. At a minimum, the door schedule shall be coordinated with Division 08 work and include the following information:
  - 1) Item Number
  - 2) Door Number (Derived from A/E Drawings)
  - 3) Floor Plan Sheet Number
  - 4) Standard Detail Number
  - 5) Door Description (Derived from Loading Sheets)
  - 6) Data Gathering Panel Input Number
  - 7) Door Position or Monitoring Device Type & Model Number

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- 8) Lock Type, Model Number & Power Input/Draw (standby/active)
  - 9) Card Reader Type & Model Number
  - 10) Shunting Device Type & Model Number
  - 11) Sounder Type & Model Number
  - 12) Manufacturer
  - 13) Misc. devices as required
    - a) Delayed Egress Type & Model Number
    - b) Intercom
    - c) Camera
    - d) Electric Transfer Hinge
    - e) Electric Pass-through device
  - 14) Remarks column indicating special notes or door configurations
2. Camera Schedule - A camera schedule shall be developed for each camera. Contractors shall coordinate with the Resident Engineer to determine camera starting numbers and naming conventions. All drawings shall identify wire and cable standardization methodology. Color coding of all wiring conductors and jackets is required and shall be communicated consistently throughout the drawings package submittal. At a minimum, the camera schedule shall include the following information:
- a. Item Number
  - b. Camera Number
  - c. Naming Conventions
  - d. Description of Camera Coverage
  - e. Camera Location
  - f. Floor Plan Sheet Number
  - g. Camera Type
  - h. Mounting Type
  - i. Standard Detail Reference
  - j. Power Input & Draw
  - k. Power Panel Location
  - l. Remarks Column for Camera
3. Section II - Data Gathering Panel Documentation Package
- a. Contractor shall provide Data Gathering Panel (DGP) input and output documentation packages for review at the Shop Drawing submittal stage and also with the as-built documentation package.

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The documentation packages shall be provided in both printed and magnetic form at both review stages.

- b. The Contractor shall provide loading sheet documentation package for the associated DGP, including input and output boards for all field panels associated with the project. Documentation shall be provided in current version Microsoft Excel spreadsheets following the format currently utilized by VA. A separate spreadsheet file shall be generated for each DGP and associated field panels.
- c. The spreadsheet names shall follow a sequence that shall display the spreadsheets in numerical order according to the DGP system number. The spreadsheet shall include the prefix in the file name that uniquely identifies the project site. The spreadsheet shall detail all connected items such as card readers, alarm inputs, and relay output connections. The spreadsheet shall include an individual section (row) for each panel input, output and card reader. The spreadsheet shall automatically calculate the system numbers for card readers, inputs, and outputs based upon data entered in initialization fields.
- d. All entries must be verified against the field devices. Copies of the floor plans shall be forwarded under separate cover.
- e. The DGP spreadsheet shall include an entry section for the following information:
  - 1) DGP number
  - 2) First Reader Number
  - 3) First Monitor Point Number
  - 4) First Relay Number
  - 5) DGP, input or output Location
  - 6) DGP Chain Number
  - 7) DGP Cabinet Tamper Input Number
  - 8) DGP Power Fail Input Number
  - 9) Number of Monitor Points Reserved For Expansion Boards
  - 10) Number of Control Points (Relays) Reserved For Expansion Boards
- f. The DGP, input module and output module spreadsheets shall automatically calculate the following information based upon the associated entries in the above fields:

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- 1) System Numbers for Card Readers
  - 2) System Numbers for Monitor Point Inputs
  - 3) System Numbers for Control Points (Relays)
  - 4) Next DGP or input module First Monitor Point Number
  - 5) Next DGP or output module First Control Point Number
- g. The DGP spreadsheet shall provide the following information for each card reader:
- 1) DGP Reader Number
  - 2) System Reader Number
  - 3) Cable ID Number
  - 4) Description Field (Room Number)
  - 5) Description Field (Device Type i.e.: In Reader, Out Reader, etc.)
  - 6) Description Field
  - 7) DGP Input Location
  - 8) Date Test
  - 9) Date Passed
  - 10) Cable Type
  - 11) Camera Numbers (of cameras viewing the reader location)
- h. The DGP and input module spreadsheet shall provide the following information for each monitor point (alarm input).
- 1) DGP Monitor Point Input Number
  - 2) System Monitor Point Number
  - 3) Cable ID Number
  - 4) Description Field (Room Number)
  - 5) Description Field (Device Type i.e.: Door Contact, Motion Detector, etc.)
  - 6) DGP or input module Input Location
  - 7) Date Test
  - 8) Date Passed
  - 9) Cable Type
  - 10) Camera Numbers (of associated alarm event preset call-ups)
- i. The DGP and output module spreadsheet shall provide the following information for each control point (output relay).
- 1) DGP Control Point (Relay) Number
  - 2) System (Control Point) Number
  - 3) Cable ID Number

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- 4) Description Field (Room Number)
- 5) Description Field (Device: Lock Control, Local Sounder, etc.)
- 6) Description Field
- 7) DGP or OUTPUT MODULE Output Location
- 8) Date Test
- 9) Date Passed Cable Type
- 10) Camera Number (of associated alarm event preset call-ups)
- j. The DGP, input module and output module spreadsheet shall include the following information or directions in the header and footer:
  - 1) Header
    - a) DGP Input and Output Worksheet
    - b) Enter Beginning Reader, Input, and Output Starting Numbers and Sheet Will Automatically Calculate the Remaining System Numbers.
  - 2) Footer:
    - a) File Name
    - b) Date Printed
    - c) Page Number
4. Section III - Construction Mock-up: In areas with exposed EMT/Conduit Raceways, contractor shall conceal raceway as much as practical and unobtrusively. In addition, historic significance must be considered to determine installation means and methods for approval by the Resident Engineer.
5. Section IV - Manufacturers' Data: The data package shall include manufacturers' data for all materials and equipment, including sensors, local processors and console equipment provided under this specification.
6. Section V - System Description and Analysis: The data package shall include system descriptions, analysis, and calculations used in sizing equipment required by these specifications. Descriptions and calculations shall show how the equipment will operate as a system to meet the performance requirements of this specification. The data package shall include the following:
  - a. Central processor memory size; communication speed and protocol description; rigid disk system size and configuration; flexible disk system size and configuration; back-up media size and configuration; alarm response time calculations; command response

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time calculations; start-up operations; expansion capability and method of implementation; sample copy of each report specified; and color photographs representative of typical graphics.

- b. Software Data: The data package shall consist of descriptions of the operation and capability of the system, and application software as specified.
  - c. Overall System Reliability Calculations: The data package shall include all manufacturers' reliability data and calculations required to show compliance with the specified reliability.
7. Section VI - Certifications & References: All specified manufacturer's certifications shall be included with the data package. Contractor shall provide Project references as outlined in Paragraph 1.4 "Quality Assurance".

K. Group II Technical Data Package:

- 1. The Contractor shall prepare a report of "Current Site Conditions" and submit a report to the Resident Engineer documenting changes to the site, particularly those conditions that affect performance of the system to be installed. The Contractor shall provide specification sheets, or written functional requirements to support the findings, and a cost estimate to correct those site changes or conditions which affect the installation of the system or its performance. The Contractor shall not correct any deficiency without written permission from the COTR.
- 2. System Configuration and Functionality: The contractor shall provide the results of the meeting with VA to develop system requirements and functionality including but not limited to:
  - a. Baseline configuration
  - b. Access levels
  - c. Schedules (intrusion detection, physical access control, holidays, etc.)
  - d. Badge database
  - e. System monitoring and reporting (unit level and central control)
  - f. Naming conventions and descriptors

L. Group III Technical Data Package:

- 1. Development of Test Procedures: The Contractor will prepare performance test procedures for the system testing. The test procedures shall follow the format of the VA Testing procedures and

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be customized to the contract requirements. The Contractor will deliver the test procedures to the Resident Engineer for approval at least 60 calendar days prior to the requested test date.

**M. Group IV Technical Data Package:**

**1. Performance Verification Test:**

a. Based on the successful completion of the pre-delivery test, the Contractor shall finalize the test procedures and report forms for the performance verification test (PVT) and the endurance test. The PVT shall follow the format, layout and content of the pre-delivery test. The Contractor shall deliver the PVT and endurance test procedures to the Resident Engineer for approval. The Contractor may schedule the PVT after receiving written approval of the test procedures. The Contractor shall deliver the final PVT and endurance test reports within 14 calendar days from completion of the tests. Refer to Part 3 of this section for System Testing and Acceptance requirements.

**2. Training Documentation:**

a. New Facilities and Major Renovations: Familiarization training shall be provided for new equipment or systems. Training can include site familiarization training for VA technicians and administrative personnel. Training shall include general information on new system layout including closet locations, turnover of the completed system including all documentation, including manuals, software, key systems, and full system administration rights. Lesson plans and training manuals training shall be oriented to type of training to be provided.

**3. System Configuration and Data Entry:**

a. The contractor is responsible for providing all system configuration and data entry for the SMS and subsystems (e.g., video matrix switch, intercom, digital video recorders, network video recorders). All data entry shall be performed per VA standards & guidelines. The Contractor is responsible for participating in all meetings with the client to compile the information needed for data entry. These meetings shall be established at the beginning of the project and incorporated in to the project schedule as a milestone task. The contractor shall be responsible for all data collection, data entry, and

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system configuration. The contractor shall collect, enter, & program and/or configure the following components:

- 1) Physical Access control system components,
- 3) Video surveillance, control and recording systems,
- 5) All other security subsystems shown in the contract documents.

- b. The Contractor is responsible for compiling the card access database for the VA employees, including programming reader configurations, access shifts, schedules, exceptions, card classes and card enrollment databases.
  - c. Refer to Part 3 for system programming requirements and planning guidelines.
4. Graphics: Based on CAD as-built drawings developed for the construction project, create all map sets showing locations of all alarms and field devices. Graphical maps of all alarm points installed under this contract including perimeter and exterior alarm points shall be delivered with the system. The Contractor shall create and install all graphics needed to make the system operational. The Contractor shall utilize data from the contract documents, Contractor's field surveys, and all other pertinent information in the Contractor's possession to complete the graphics. The Contractor shall identify and request from the COTR, any additional data needed to provide a complete graphics package. Graphics shall have sufficient level of detail for the system operator to assess the alarm. The Contractor shall supply hard copy, color examples at least 203.2 x 254 mm (8 x 10 in) of each type of graphic to be used for the completed Security system. The graphics examples shall be delivered to the Resident Engineer for review and approval at least 90 calendar days prior to the scheduled date the Contractor requires them.
- N. Group V Technical Data Package: Final copies of the manuals shall be delivered to the Resident Engineer as part of the acceptance test. The draft copy used during site testing shall be updated with any changes required prior to final delivery of the manuals. Each manual's contents shall be identified on the cover. The manual shall include names, addresses, and telephone numbers of each sub-contractor installing equipment or systems, as well as the nearest service representatives for each item of equipment for each system. The



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manuals shall include a table of contents and tab sheets. Tab sheets shall be placed at the beginning of each chapter or section and at the beginning of each appendix. The final copies delivered after completion of the endurance test shall include all modifications made during installation, checkout, and acceptance. Six (6) hard-copies and one (1) soft copy on CD of each item listed below shall be delivered as a part of final systems acceptance.

1. Functional Design Manual: The functional design manual shall identify the operational requirements for the entire system and explain the theory of operation, design philosophy, and specific functions. A description of hardware and software functions, interfaces, and requirements shall be included for all system operating modes. Manufacturer developed literature may be used; however, shall be produced to match the project requirements.
2. Equipment Manual: A manual describing all equipment furnished including:
  - a. General description and specifications; installation and checkout procedures; equipment electrical schematics and layout drawings; system schematics and layout drawings; alignment and calibration procedures; manufacturer's repair list indicating sources of supply; and interface definition.
3. Software Manual: The software manual shall describe the functions of all software and include all other information necessary to enable proper loading, testing, and operation. The manual shall include:
  - a. Definition of terms and functions; use of system and applications software; procedures for system initialization, start-up, and shutdown; alarm reports; reports generation, database format and data entry requirements; directory of all disk files; and description of all communications protocols including data formats, command characters, and a sample of each type of data transfer.
4. Operator's Manual: The operator's manual shall fully explain all procedures and instructions for the operation of the system, including:
  - a. Computers and peripherals; system start-up and shutdown procedures; use of system, command, and applications software;

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recovery and restart procedures; graphic alarm presentation; use of report generator and generation of reports; data entry; operator commands' alarm messages, and printing formats; and system access requirements.

5. Maintenance Manual: The maintenance manual shall include descriptions of maintenance for all equipment including inspection, recommend schedules, periodic preventive maintenance, fault diagnosis, and repair or replacement of defective components.
6. Spare Parts & Components Data: At the conclusion of the Contractor's work, the Contractor shall submit to the Resident Engineer a complete list of the manufacturer's recommended spare parts and components required to satisfactorily maintain and service the systems, as well as unit pricing for those parts and components.
7. Operation, Maintenance & Service Manuals: The Contractor shall provide two (2) complete sets of operating and maintenance manuals in the form of an instructional manual for use by the VA Security Guard Force personnel. The manuals shall be organized into suitable sets of manageable size. Where possible, assemble instructions for similar equipment into a single binder. If multiple volumes are required, each volume shall be fully indexed and coordinated.
8. Equipment and Systems Maintenance Manual: The Contractor shall provide the following descriptive information for each piece of equipment, operating system, and electronic system:
  - a. Equipment and/or system function.
  - b. Operating characteristics.
  - c. Limiting conditions.
  - d. Performance curves.
  - e. Engineering data and test.
  - f. Complete nomenclature and number of replacement parts.
  - g. Provide operating and maintenance instructions including assembly drawings and diagrams required for maintenance and a list of items recommended to stock as spare parts.
  - h. Provide information detailing essential maintenance procedures including the following: routine operations, trouble shooting guide, disassembly, repair and re-assembly, alignment, adjusting, and checking.

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- i. Provide information on equipment and system operating procedures, including the following; start-up procedures, routine and normal operating instructions, regulation and control procedures, instructions on stopping, shut-down and emergency instructions, required sequences for electric and electronic systems, and special operating instructions.
  - j. Manufacturer equipment and systems maintenance manuals are permissible.
9. Project Redlines: During construction, the Contractor shall maintain an up-to-date set of construction redlines detailing current location and configuration of the project components. The redline documents shall be marked with the words 'Master Redlines' on the cover sheet and be maintained by the Contractor in the project office. The Contractor will provide access to redline documents anytime during the project for review and inspection by the Resident Engineer or authorized Office of Protection Services representative. Master redlines shall be neatly maintained throughout the project and secured under lock and key in the contractor's onsite project office. Any project component or assembly that is not installed in strict accordance with the drawings shall be so noted on the drawings. Prior to producing Record Construction Documents, the contractor will submit the Master Redline document to the Resident Engineer for review and approval of all changes or modifications to the documents. Each sheet shall have Resident Engineer initials indicating authorization to produce "As Built" documents. Field drawings shall be used for data gathering & field changes. These changes shall be made to the master redline documents daily. Field drawings shall not be considered "master redlines".
10. Record Specifications: The Contractor shall maintain one (1) copy of the Project Specifications, including addenda and modifications issued, for Project Record Documents. The Contractor shall mark the Specifications to indicate the actual installation where the installation varies substantially from that indicated in the Contract Specifications and modifications issued. (Note related Project Record Drawing information where applicable). The Contractor shall pay particular attention to substitutions,

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selection of product options, and information on concealed installations that would be difficult to identify or measure and record later. Upon completion of the mark ups, the Contractor shall submit record Specifications to the COTR. As with master relines, Contractor shall maintain record specifications for Resident Engineer review and inspection at anytime.

11. Record Product Data: The Contractor shall maintain one (1) copy of each Product Data submittal for Project Record Document purposes. The Data shall be marked to indicate the actual product installed where the installation varies substantially from that indicated in the Product Data submitted. Significant changes in the product delivered to the site and changes in manufacturer's instructions and recommendations for installation shall be included. Particular attention will be given to information on concealed products and installations that cannot be readily identified or recorded later. Note related Change Orders and mark up of Record Construction Documents, where applicable. Upon completion of mark up, submit a complete set of Record Product Data to the COTR.
12. Miscellaneous Records: The Contractor shall maintain one (1) copy of miscellaneous records for Project Record Document purposes. Refer to other Specifications for miscellaneous record-keeping requirements and submittals concerning various construction activities. Before substantial completion, complete miscellaneous records and place in good order, properly identified and bound or filed, ready for use and reference. Categories of requirements resulting in miscellaneous records include, a minimum of the following:
  - a. Certificates received instead of labels on bulk products.
  - b. Testing and qualification of tradesmen. ("Contractor's Qualifications")
  - c. Documented qualification of installation firms.
  - d. Load and performance testing.
  - e. Inspections and certifications.
  - f. Final inspection and correction procedures.
  - g. Project schedule

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13. Record Construction Documents (Record As-Built)

- a. Upon project completion, the contractor shall submit the project master redlines to the Resident Engineer prior to development of Record construction documents. The Resident Engineer shall be given a minimum of a thirty (30) day review period to determine the adequacy of the master redlines. If the master redlines are found suitable by the Resident Engineer, the Resident Engineer will initial and date each sheet and turn redlines over to the contractor for as built development.
- b. The Contractor shall provide the Resident Engineer a complete set of "as-built" drawings and original master redlined marked "as-built" blue-line in the latest version of AutoCAD drawings unlocked on CD or DVD. The as-built drawing shall include security device number, security closet connection location, data gathering panel number, and input or output number as applicable. All corrective notations made by the Contractor shall be legible when submitted to the COTR. If, in the opinion of the COTR, any redlined notation is not legible, it shall be returned to the Contractor for re-submission at no extra cost to the VAMC. The Contractor shall organize the Record Drawing sheets into manageable sets bound with durable paper cover sheets with suitable titles, dates, and other identifications printed on the cover. The submitted as built shall be in editable formats and the ownership of the drawings shall be fully relinquished to the VAMC.
- c. Where feasible, the individual or entity that obtained record data, whether the individual or entity is the installer, sub-contractor, or similar entity, is required to prepare the mark up on Record Drawings. Accurately record the information in a comprehensive drawing technique. Record the data when possible after it has been obtained. For concealed installations, record and check the mark up before concealment. At the time of substantial completion, submit the Record Construction Documents to the COTR. The Contractor shall organize into bound and labeled sets for the COTR's continued usage. Provide device, conduit, and cable lengths on the conduit drawings. Exact in-field conduit placement/routings shall be shown. All conduits

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shall be illustrated in their entire length from termination in security closets; no arrowed conduit runs shall be shown. Pull box and junction box sizes are to be shown if larger than 100mm (4 inch).

## O. FIPS 201 Compliance Certificates

1. Provide Certificates for all software components and device types utilizing credential verification. Provide certificates for:

- a. Card Readers
- b. PIV Middleware
- c. Template Matcher
- d. Electromagnetically Opaque Sleeve
- e. Certificate Management
  - 1) CAK Authentication System
  - 2) PIV Authentication System
  - 3) Certificate Validator
  - 4) Cryptographic Module

P. Approvals will be based on complete submission of manuals together with shop drawings.

Q. Completed System Readiness Checklists provided by the Commissioning Agent and completed by the contractor, signed by a qualified technician and dated on the date of completion, in accordance with the requirements of Section 28 08 00, COMMISSIONING OF ELECTRONIC SAFETY AND SECURITY SYSTEMS.

## 1.5 APPLICABLE PUBLICATIONS

A. The publications listed below (including amendments, addenda, revisions, supplement, and errata) form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.

B. American National Standards Institute (ANSI)/ Security Industry Association (SIA):

AC-03 .....Access Control: Access Control Guideline Dye  
Sublimation Printing Practices for PVC Access  
Control Cards

TVAC-01 .....CCTV to Access Control Standard - Message Set  
for System Integration

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- C. American National Standards Institute (ANSI)/ International Code Council (ICC):
  - A117.1 .....Standard on Accessible and Usable Buildings and Facilities
- D. Department of Justice American Disability Act (ADA)
  - 28 CFR Part 36 .....ADA Standards for Accessible Design 2010
- E. Department of Veterans Affairs (VA):
  - PACS-R: .....Physical Access Control System (PACS) Requirements
  - VA Handbook 0730 .....Security and Law Enforcement
- F. Government Accountability Office (GAO):
  - GAO-03-8-02 Security Responsibilities for Federally Owned and Leased Facilities
- G. National Electrical Contractors Association
  - 303-2005 .....Installing Closed Circuit Television (CCTV) Systems
- H. National Electrical Manufacturers Association (NEMA):
  - 250-08 .....Enclosures for Electrical Equipment (1000 Volts Maximum)
- I. National Fire Protection Association (NFPA):
  - 70-11 ..... National Electrical Code
- J. Underwriters Laboratories, Inc. (UL):
  - 294-99 .....The Standard of Safety for Access Control System Units
  - 305-08 .....Standard for Panic Hardware
  - 639-97 .....Standard for Intrusion-Detection Units
  - 752-05 .....Standard for Bullet-Resisting Equipment
  - 827-08 .....Central Station Alarm Services
  - 1076-95 .....Standards for Proprietary Burglar Alarm Units and Systems
  - 1981-03 .....Central Station Automation System
  - 2058-05 .....High Security Electronic Locks
- K. Homeland Security Presidential Directive (HSPD):
  - HSPD-12 .....Policy for a Common Identification Standard for Federal Employees and Contractors

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L. Federal Communications Commission (FCC):

(47 CFR 15) Part 15 Limitations on the Use of Wireless Equipment/Systems

M. Federal Information Processing Standards (FIPS):

FIPS-201-1 .....Personal Identity Verification (PIV) of Federal  
Employees and Contractors

N. National Institute of Standards and Technology (NIST):

IR 6887 V2.1 .....Government Smart Card Interoperability  
Specification (GSC-IS)

Special Pub 800-63 .....Electronic Authentication Guideline

Special Pub 800-96 .....PIV Card Reader Interoperability Guidelines

Special Pub 800-73-3 ...Interfaces for Personal Identity Verification  
(4 Parts)

.....Pt. 1- End Point PIV Card Application  
Namespace, Data Model & Representation

.....Pt. 2- PIV Card Application Card Command  
Interface

.....Pt. 3- PIV Client Application Programming  
Interface

.....Pt. 4- The PIV Transitional Interfaces & Data  
Model Specification

Special Pub 800-76-1 ...Biometric Data Specification for Personal  
Identity Verification

Special Pub 800-78-2 ...Cryptographic Algorithms and Key Sizes for  
Personal Identity Verification

Special Pub 800-79-1 ...Guidelines for the Accreditation of Personal  
Identity Verification Card Issuers

Special Pub 800-85B-1 ..DRAFTPIV Data Model Test Guidelines

Special Pub 800-85A-2 ..PIV Card Application and Middleware Interface  
Test Guidelines (SP 800-73-3 compliance)

Special Pub 800-96 .....PIV Card Reader Interoperability Guidelines

Special Pub 800-37 .....Guide for Applying the Risk Management  
Framework to Federal Information Systems

Special Pub 800-96 .....PIV Card Reader Interoperability Guidelines

Special Pub 800-96 .....PIV Card Reader Interoperability Guidelines

Special Pub 800-104A ...Scheme for PIV Visual Card Topography

Special Pub 800-116 ....Recommendation for the Use of PIV Credentials  
in Physical Access Control Systems (PACS)



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- O. Institute of Electrical and Electronics Engineers (IEEE):
  - C62.41 .....IEEE Recommended Practice on Surge Voltages in  
Low-Voltage AC Power Circuits
- P. International Organization for Standardization (ISO):
  - 7810 .....Identification cards - Physical characteristics
  - 7811 .....Physical Characteristics for Magnetic Stripe  
Cards
  - 7816-1 .....Identification cards - Integrated circuit(s)  
cards with contacts - Part 1: Physical  
characteristics
  - 7816-2 .....Identification cards - Integrated circuit cards  
- Part 2: Cards with contacts -Dimensions and  
location of the contacts
  - 7816-3 .....Identification cards - Integrated circuit cards  
- Part 3: Cards with contacts - Electrical  
interface and transmission protocols
  - 7816-4 .....Identification cards - Integrated circuit cards  
- Part 11: Personal verification through  
biometric methods
  - 7816-10 .....Identification cards - Integrated circuit cards  
- Part 4: Organization, security and commands  
for interchange
  - 14443 .....Identification cards - Contactless integrated  
circuit cards; Contactless Proximity Cards  
Operating at 13.56 MHz in up to 5 inches  
distance
  - 15693 .....Identification cards -- Contactless integrated  
circuit cards - Vicinity cards; Contactless  
Vicinity Cards Operating at 13.56 MHz in up to  
50 inches distance
  - 19794 .....Information technology - Biometric data  
interchange formats
- Q. Uniform Federal Accessibility Standards (UFAS) 1984
- R. ADA Standards for Accessible Design 2010
- S. Section 508 of the Rehabilitation Act of 1973

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**1.6 DEFINITIONS**

- A. ABA Track: Magnetic stripe that is encoded on track 2, at 75-bpi density in binary-coded decimal format; for example, 5-bit, 16-character set.
- B. Access Control List: A list of (identifier, permissions) pairs associated with a resource or an asset. As an expression of security policy, a person may perform an operation on a resource or asset if and only if the person's identifier is present in the access control list (explicitly or implicitly), and the permissions in the (identifier, permissions) pair include the permission to perform the requested operation.
- C. Access Control: A function or a system that restricts access to authorized persons only.
- D. API Application Programming Interface
- E. Assurance Level (or E-Authentication Assurance Level): A measure of trust or confidence in an authentication mechanism defined in OMB Memorandum M-04-04 and NIST Special Publication (SP) 800-63, in terms of four levels:
  - 1. Level 1: LITTLE OR NO confidence
  - 2. Level 2: SOME confidence
  - 3. Level 3: HIGH confidence
  - 4. Level 4: VERY HIGH confidence
- F. Authentication: A process that establishes the origin of information, or determines an entity's identity. In this publication, authentication often means the performance of a PIV authentication mechanism.
- G. Authenticator: A memory, possession, or quality of a person that can serve as proof of identity, when presented to a verifier of the appropriate kind. For example, passwords, cryptographic keys, and fingerprints are authenticators.
- H. Authorization: A process that associates permission to access a resource or asset with a person and the person's identifier(s).
- I. BIO or BIO-A: A FIPS 201 authentication mechanism that is implemented by using a Fingerprint data object sent from the PIV Card to the PACS. Note that the short-hand "BIO (-A)" is used throughout the document to represent both BIO and BIO-A authentication mechanisms.
- J. Biometric: An authenticator produced from measurable qualities of a living person.

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- K. CAC EP - CAC End Point with end point PIV applet
- L. CAC NG - CAC Next Generation with transitional PIV applet
- M. Card Authentication Key (CAK): A PIV authentication mechanism (or the PIV Card key of the same name) that is implemented by an asymmetric or symmetric key challenge/response protocol. The CAK is an optional mechanism defined in NIST SP 800-73. NIST strongly recommends that every PIV Card contain an asymmetric CAK and corresponding certificate, and that agencies use the asymmetric CAK protocol, rather than a symmetric CAK protocol, whenever the CAK authentication mechanism is used with PACS.
- N. CCTV: Closed-circuit television.
- O. Central Station: A PC with software designated as the main controlling PC of the PACS. Where this term is presented with initial capital letters, this definition applies.
- P. Controller: An intelligent peripheral control unit that uses a computer for controlling its operation. Where this term is presented with an initial capital letter, this definition applies.
- Q. CPU: Central processing unit.
- R. Credential: Data assigned to an entity and used to identify that entity.
- S. File Server: A PC in a network that stores the programs and data files shared by users.
- T. FIPS Federal Information Processing Standards
- U. FRAC - First Responder Authentication Credential
- V. HSPD Homeland Security Presidential Directive
- W. I/O: Input/Output.
- X. Identifier: A credential card, keypad personal identification number or code, biometric characteristic, or other unique identification entered as data into the entry-control database for the purpose of identifying an individual. Where this term is presented with an initial capital letter, this definition applies.
- Y. IEC International Electrotechnical Commission
- Z. ISO International Organization for Standardization
- AA. KB Kilobyte
- BB. kbit/s Kilobits / second
- CC. LAN: Local area network.
- DD. LED: Light-emitting diode.

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- EE. Legacy CAC - Contact only Common Access Card with v1 and v2 applets
- FF. Location: A Location on the network having a PC-to-Controller communications link, with additional Controllers at the Location connected to the PC-to-Controller link with RS-485 communications loop. Where this term is presented with an initial capital letter, this definition applies.
- GG. NIST: National Institute of Standards and Technology
- HH. PACS: Physical Access Control System
- II. PC/SC: Personal Computer / Smart Card
- JJ. PC: Personal computer. This acronym applies to the Central Station, workstations, and file servers.
- KK. PCI Bus: Peripheral component interconnect; a peripheral bus providing a high-speed data path between the CPU and peripheral devices (such as monitor, disk drive, or network).
- LL. PDF: (Portable Document Format.) The file format used by the Acrobat document exchange system software from Adobe.
- MM. PIV: Personal Identification Verification
- NN. PIV-I - PIV Interoperable credential
- OO. PPS: Protocol and Parameters Selection
- PP. RF: Radio frequency.
- QQ. ROM: Read-only memory. ROM data are maintained through losses of power.
- RR. RS-232: A TIA/EIA standard for asynchronous serial data communications between terminal devices. This standard defines a 25-pin connector and certain signal characteristics for interfacing computer equipment.
- SS. RS-485: An TIA/EIA standard for multipoint communications.
- TT. TCP/IP: Transport control protocol/Internet protocol incorporated into Microsoft Windows.
- UU. TPDU: Transport Protocol Data Unit
- VV. TWIC - Transportation Worker Identification Credential
- WW. UPS: Uninterruptible power supply.
- XX. Vcc: Voltage at the Common Collector
- YY. WAN: Wide area network.
- ZZ. WAV: The digital audio format used in Microsoft Windows.
- AAA. Wiegand: Patented magnetic principle that uses specially treated wires embedded in the credential card.
- BBB. Windows: Operating system by Microsoft Corporation.

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CCC. Workstation: A PC with software that is configured for specific limited security system functions.

**1.7 COORDINATION**

- A. Coordinate arrangement, mounting, and support of electronic safety and security equipment:
  - 1. To allow maximum possible headroom unless specific mounting heights that reduce headroom are indicated.
  - 2. To provide for ease of disconnecting the equipment with minimum interference to other installations.
  - 3. To allow right of way for piping and conduit installed at required slope.
  - 4. So connecting raceways, cables, wireways, cable trays, and busways will be clear of obstructions and of the working and access space of other equipment.
- B. Coordinate installation of required supporting devices and set sleeves in cast-in-place concrete, masonry walls, and other structural components as they are constructed.
- C. Coordinate location of access panels and doors for electronic safety and security items that are behind finished surfaces or otherwise concealed.

**1.8 MAINTENANCE & SERVICE**

- A. General Requirements:
  - 1. The Contractor shall provide all services required and equipment necessary to maintain the entire integrated electronic security system in an operational state as specified for a period of one (1) year after formal written acceptance of the system. The Contractor shall provide all necessary material required for performing scheduled adjustments or other non-scheduled work. Impacts on facility operations shall be minimized when performing scheduled adjustments or other non-scheduled work. See also General Project Requirements.
- B. Description of Work:
  - 1. The adjustment and repair of the security system includes all software updates, panel firmware, and the following new items computers equipment, communications transmission equipment and data transmission media (DTM), local processors, security system sensors,

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physical access control equipment, facility interface, signal transmission equipment, and video equipment.

**C. Personnel:**

1. Service personnel shall be certified in the maintenance and repair of the selected type of equipment and qualified to accomplish all work promptly and satisfactorily. The Resident Engineer shall be advised in writing of the name of the designated service representative, and of any change in personnel. The Resident Engineer shall be provided copies of system manufacturer certification for the designated service representative.

**D. Schedule of Work:**

1. The work shall be performed during regular working ours, Monday through Friday, excluding federal holidays. These inspections shall include:
  - a) The Contractor shall perform two (2) minor inspections at six (6) month intervals or more if required by the manufacturer, and two (2) major inspections offset equally between the minor inspections to effect quarterly inspection of alternating magnitude.
    - 1) Minor Inspections shall include visual checks and operational tests of all console equipment, peripheral equipment, local processors, sensors, electrical and mechanical controls, and adjustments on printers.
    - 2) Major Inspections shall include all work described for Minor Inspections and the following: clean all system equipment and local processors including interior and exterior surfaces; perform diagnostics on all equipment; operational tests of the CPU, switcher, peripheral equipment, recording devices, monitors, picture quality from each camera; check, walk test, and calibrate each sensor; run all system software diagnostics and correct all problems; and resolve any previous outstanding problems.

**E. Emergency Service:**

1. The Resident Engineer shall initiate service calls whenever the system is not functioning properly. The Contractor shall provide the Resident Engineer with an emergency service center telephone number. The emergency service center shall be staffed 24 hours a

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day 365 days a year. The Resident Engineer shall have sole authority for determining catastrophic and non-catastrophic system failures within parameters stated in General Project Requirements.

- a. For catastrophic system failures, the Contractor shall provide same day four (4) hour service response with a defect correction time not to exceed eight (8) hours from notification.

Catastrophic system failures are defined as any system failure that the Resident Engineer determines will place the facility(s) at increased risk.

- b. For non-catastrophic failures, the Contractor within eight (8) hours with a defect correction time not to exceed 24 hours from notification.

**F. Operation:**

1. Performance of scheduled adjustments and repair shall verify operation of the system as demonstrated by the applicable portions of the performance verification test.

**G. Records & Logs:**

1. The Contractor shall maintain records and logs of each task and organize cumulative records for each component and for the complete system chronologically. A continuous log shall be submitted for all devices. The log shall contain all initial settings, calibration, repair, and programming data. Complete logs shall be maintained and available for inspection on site, demonstrating planned and systematic adjustments and repairs have been accomplished for the system.

**H. Work Request:**

1. The Contractor shall separately record each service call request, as received. The record shall include the serial number identifying the component involved, its location, date and time the call was received, specific nature of trouble, names of service personnel assigned to the task, instructions describing the action taken, the amount and nature of the materials used, and the date and time of commencement and completion. The Contractor shall deliver a record of the work performed within five (5) working days after the work was completed.

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**I. System Modifications:**

1. The Contractor shall make any recommendations for system modification in writing to the COTR. No system modifications, including operating parameters and control settings, shall be made without prior written approval from the COTR. Any modifications made to the system shall be incorporated into the operation and maintenance manuals and other documentation affected.

**J. Software:**

1. The Contractor shall provide all software updates when approved by the Resident Engineer from the manufacturer during the installation and 12-month warranty period and verify operation of the system. These updates shall be accomplished in a timely manner, fully coordinated with the system operators, and incorporated into the operations and maintenance manuals and software documentation. There shall be at least one (1) scheduled update near the end of the first year's warranty period, at which time the Contractor shall install and validate the latest released version of the Manufacturer's software. All software changes shall be recorded in a log maintained in the unit control room. An electronic copy of the software update shall be maintained within the log. At a minimum, the contractor shall provide a description of the modification, when the modification occurred, and name and contact information of the individual performing the modification. The log shall be maintained in a white 3 ring binder and the cover marked "SOFTWARE CHANGE LOG".

**1.9 PERFORMANCE REQUIREMENTS**

- A. PACS shall provide support for multiple authentication modes and bidirectional communication with the reader. PACS shall provide implementation capability for enterprise security policy and incident response.
- B. All processing of authentication information must occur on the "safe side" of a door.
- C. Physical Access Control System shall provide access to following Security Areas:
  1. Controlled.
  2. Limited.



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- D. PACS shall provide:
  - 1. One authentication factor for access to Controlled security areas.
  - 2. Two authentication factors for access to Limited security areas.
- E. PACS shall provide Credential Validation and Path Validation per NIST 800-116.
- F. The PACS System shall have an Enterprise Path Validation Module (PVM) component that processes X.509 certification paths composed of X.509 v3 certificates and X.509 v2 CRLs. The PVM component MUST support the following features:
  - 1. Name chaining.
  - 2. Signature chaining.
  - 3. Certificate validity.
  - 4. Key usage, basic constraints, and certificate policies certificate extensions.
  - 5. Full CRLs; and
  - 6. CRLs segmented on names.
- G. Number of Locations: Support unlimited number of separate Locations using a single PC with combinations of direct-connect, dial-up, or TCP/IP LAN connections to each Location.
  - 1. Each Location shall have its own database and history in the Central Station. Locations may be combined to share a common database.
- H. Data Capacity:
  - 1. 130 different card-reader formats.
  - 2. 999 comments.
  - 3. 16 graphic file types for importing maps.
- I. Location Capacity:
  - 1. 128 reader-controlled doors.
  - 2. 50,000 total access credentials.
  - 3. 2048 supervised alarm inputs.
  - 4. 2048 programmable outputs.
  - 5. 32,000 custom action messages per Location to instruct operator on action required when alarm is received.
- J. System Network Requirements:
  - 1. Interconnect system components and provide automatic communication of status changes, commands, field-initiated interrupts, and other communications required for proper system operation.

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2. Communication shall not require operator initiation or response, and shall return to normal after partial or total network interruption such as power loss or transient upset.
  3. System shall automatically annunciate communication failures to the operator and identify the communication link that has experienced a partial or total failure.
- K. Field equipment shall include Controllers, sensors, and controls. Controllers shall serve as an interface between the Central Station and sensors and controls. Data exchange between the Central Station and the Controllers shall include down-line transmission of commands, software, and databases to Controllers. The up-line data exchange from the Controller to the Central Station shall include status data such as intrusion alarms, status reports, and entry-control records. Controllers are classified as alarm-annunciation or entry-control type.
- L. System Response to Alarms: Field device network shall provide a system end-to-end response time of 1 second(s) or less for every device connected to the system. Alarms shall be annunciated at the Central Station within 1 second of the alarm occurring at a Controller or device controlled by a local Controller, and within 100 ms if the alarm occurs at the Central Station. Alarm and status changes shall be displayed within 100 ms after receipt of data by the Central Station. All graphics shall be displayed, including graphics-generated map displays, on the console monitor within 5 seconds of alarm receipt at the security console. This response time shall be maintained during system heavy load.
- M. False Alarm Reduction: The design of Central Station and Controllers shall contain features to reduce false alarms. Equipment and software shall comply with SIA CP-01.
- N. Error Detection: A cyclic code error detection method shall be used between Controllers and the Central Station, which shall detect single- and double-bit errors, burst errors of eight bits or less, and at least 99 percent of all other multibit and burst error conditions. Interactive or product error detection codes alone will not be acceptable. A message shall be in error if one bit is received incorrectly. System shall retransmit messages with detected errors. A two-digit decimal number shall be operator assignable to each communication link representing the number of retransmission attempts.

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When the number of consecutive retransmission attempts equals the assigned quantity, the Central Station shall print a communication failure alarm message. System shall monitor the frequency of data transmission failure for display and logging.

- O. Data Line Supervision: System shall initiate an alarm in response to opening, closing, shorting, or grounding of data transmission lines.
- P. Door Hardware Interface: Coordinate with Division 08 Sections that specify door hardware required to be monitored or controlled by the PACS. The Controllers in this Section shall have electrical characteristics that match the signal and power requirements of door hardware. Integrate door hardware specified in Division 08 Sections to function with the controls and PC-based software and hardware in this Section.
- Q. References to industry and trade association standards and codes are minimum installation requirement standards.
- R. Drawings and other specification sections shall govern in those instances where requirements are greater than those specified in the above standards.

**1.10 EQUIPMENT AND MATERIALS**

- A. Materials and equipment furnished shall be of current production by manufacturers regularly engaged in the manufacture of such items, for which replacement parts shall be available.
- B. When more than one unit of the same class of equipment is required, such units shall be the product of a single manufacturer.
- C. Equipment Assemblies and Components:
  - 1. Components of an assembled unit need not be products of the same manufacturer.
  - 2. Manufacturers of equipment assemblies, which include components made by others, shall assume complete responsibility for the final assembled unit.
  - 3. Components shall be compatible with each other and with the total assembly for the intended service.
  - 4. Constituent parts which are similar shall be the product of a single manufacturer.
- D. Factory wiring shall be identified on the equipment being furnished and on all wiring diagrams.

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**E. When Factory Testing Is Specified:**

1. The Government shall have the option of witnessing factory tests.  
The contractor shall notify the VA through the Resident Engineer a minimum of 15 working days prior to the manufacturers making the factory tests.
2. Four copies of certified test reports containing all test data shall be furnished to the Resident Engineer prior to final inspection and not more than 90 days after completion of the tests.
3. When equipment fails to meet factory test and re-inspection is required, the contractor shall be liable for all additional expenses, including expenses of the Government.

**1.11 WARRANTY OF CONSTRUCTION.**

- A. Warrant PACS work subject to the Article "Warranty of Construction" of FAR clause 52.246-21.
- B. Demonstration and training shall be performed prior to system acceptance.

**1.12 GENERAL REQUIREMENTS**

- A. For general requirements that are common to more than one section in Division 28, refer to Section 28 05 00, REQUIREMENTS FOR ELECTRONIC SAFETY AND SECURITY INSTALLATIONS.
- B. General requirements applicable to this section include:
  1. General Arrangement of Contract Documents,
  2. Delivery, Handling and Storage,
  3. Project Conditions,
  4. Electrical Power,
  5. Lightning, Power Surge Suppression, and Grounding,
  6. Electronic Components,
  7. Substitute Materials and Equipment, and
  8. Like Items.

**PART 2 - PRODUCTS**

**2.1 GENERAL**

- A. All equipment and materials for the system will be compatible to ensure correct operation as outlined in FIPS 201, March 2006 and HSPD-12.
- B. The security system characteristics listed in this section will serve as a guide in selection of equipment and materials for the PACS. If updated or more suitable versions are available then the Contracting Officer will approve the acceptance of prior to an installation.

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C. PACS equipment shall meet or exceed all requirements listed below.

D. A PACS shall be comprised of, but not limited to, the following components:

1. Physical Access Control System
2. Application Software
3. System Database
4. Surge and Tamper Protection
5. Standard Workstation Hardware
6. Communications Workstation
7. Controllers (Data Gathering Panel)
8. Secondary Alarm Annunciator
9. Keypads
10. Card Readers
11. Interfaces
12. Door and Gate Hardware interface
13. RS-232 ASCII Interface
14. Video and Camera Control
15. Cables
16. Transformers

**2.2 SECURITY MANAGEMENT SYSTEM (SMS)**

A. Shall allow the configuration of an enrollment and badging, alarm monitoring, administrative, asset management, digital video management, intrusion detection, visitor enrollment, remote access level management, and integrated client workstations or any combination of all or some.

B. Shall be expandable to support an unlimited number of individual module or integrated client workstations. All access control field hardware, including Data Gathering Panels (DGP), shall be connected to all physical access control system workstation on the network.

C. Shall have the ability to compose, file, maintain, update, and print reports for either individuals or the system as follows.

1. Individual reports that consist of an employee's name, office location, phone number or direct extension, and normal hours of operation. The report shall provide a detail listing of the employee's daily events in relation to accessing points within a facility.

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2. System reports shall be able to produce information on a daily/weekly/monthly basis for all events, alarms, and any other activity associated with a system user.
- D. All reports shall be in a date/time format and all information shall be clearly presented. Shall be designed to allow it to work with any industry standard network protocol and topology listed below:
1. Transmission Control Protocol (TCP)/IP
  2. Novell Netware (IPX/SPX)
  3. Banyan VINES
  4. IBM LAN Server (NetBEUI)
  5. Microsoft LAN Manager (NetBEUI)
  6. Network File System (NFS) Networks
  7. Remote Access Service (RAS) via ISDN, x.25, and standard phone lines.
- E. Shall provide full interface and control of the PACS to include the following subsystems within the PACS:
1. Public Key Infrastructure
  2. Card Management
  3. Identity and Access Management
  4. Personal Identity Verification
- F. Shall have the following features or compatibilities:
1. The ability to be operated locally or remotely via a LAN, WAN, internet, or intranet.
  2. Event and Alarm Monitoring
  3. Database Partitioning
  4. Ability to fully integrate with all other security subsystems
  5. Enhanced Monitoring Station with Split Screen Views
  6. Alternate and Extended Shunt by Door
  7. Escort Management
  8. Enhanced IT-based Password Protection
  9. N-man Rule and Occupancy Restrictions
  10. Open Journal Data Format for Enhanced Reporting
  11. Automated Personnel Import
  12. ODBC Support
  13. Windows 2000 Professional, Windows Server 2003, Windows XP Professionals for Servers, Windows 7
  14. Field-Level Audit Trail

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15. Cardholder Access Events

**2.3 APPLICATION SOFTWARE**

- A. System Software: Based on 32-bit, Microsoft Windows central-station and workstation operating system and application software. Software shall have the following features:
1. Multiuser multitasking to allow independent activities and monitoring to occur simultaneously at different workstations.
  2. Graphical user interface to show pull-down menus and a menu tree format.
  3. Capability for future additions within the indicated system size limits.
  4. Open architecture that allows importing and exporting of data and interfacing with other systems that are compatible with operating system.
  5. Password-protected operator and smart card login and access.
- B. Peer Computer Control Software: Shall detect a failure of a central computer, and shall cause the other central computer to assume control of all system functions without interruption of operation. Drivers shall be provided in both central computers to support this mode of operation.
- C. Application Software: Interface between the alarm annunciation and entry-control Controllers, to monitor sensors and DTS links, operate displays, report alarms, generate reports, and help train system operators. Software shall have the following functions:
1. Resides at the Central Station, workstations, and Controllers as required to perform specified functions.
  2. Operate and manage peripheral devices.
  3. Manage files for disk I/O, including creating, deleting, and copying files; and automatically maintain a directory of all files, including size and location of each sequential and random-ordered record.
  4. Import custom icons into graphics views to represent alarms and I/O devices.
  5. Globally link I/O so that any I/O can link to any other I/O within the same Location, without requiring interaction with the host PC. This operation shall be at the Controller.

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6. Globally code I/O links so that any access-granted event can link to any I/O with the same Location without requiring interaction with the host PC. This operation shall be at the Controller.
7. Messages from PC to Controllers and Controllers to Controllers shall be on a polled network that utilizes check summing and acknowledgment of each message. Communication shall be automatically verified, buffered, and retransmitted if message is not acknowledged.
8. Selectable poll frequency and message time-out settings shall handle bandwidth and latency issues for TCP/IP, RF, and other PC-to-Controller communications methods by changing the polling frequency and the amount of time the system waits for a response.
9. Automatic and encrypted backups for database and history backups shall be automatically stored at the central control PC and encrypted with a nine-character alphanumeric password, which must be used to restore or read data contained in backup.
10. Operator audit trail for recording and reporting all changes made to database and system software.

**D. Workstation Software:**

1. Password levels shall be individually customized at each workstation to allow or disallow operator access to program functions for each Location.
2. Workstation event filtering shall allow user to define events and alarms that will be displayed at each workstation. If an alarm is unacknowledged (not handled by another workstation) for a preset amount of time, the alarm will automatically appear on the filtered workstation.

**E. Controller Software:**

1. Controllers shall operate as an autonomous intelligent processing unit. Controllers shall make decisions about physical access control, alarm monitoring, linking functions, and door locking schedules for its operation, independent of other system components. Controllers shall be part of a fully distributed processing control network. The portion of the database associated with a Controller and consisting of parameters, constraints, and the latest value or status of points connected to that Controller, shall be maintained in the Controller.



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2. Functions: The following functions shall be fully implemented and operational within each Controller:
  - a. Monitoring inputs.
  - b. Controlling outputs.
  - c. Automatically reporting alarms to the Central Station.
  - d. Reporting of sensor and output status to Central Station on request.
  - e. Maintaining real time, automatically updated by the Central Station at least once a day.
  - f. Communicating with the Central Station.
  - g. Executing Controller resident programs.
  - h. Diagnosing.
  - i. Downloading and uploading data to and from the Central Station.
3. Controller Operations at a Location:
  - a. Location: Up to 64 Controllers connected to RS-485 communications loop. Globally operating I/O linking and anti-passback functions between Controllers within the same Location without central-station or workstation intervention. Linking and anti-passback shall remain fully functional within the same Location even when the Central Station or workstations are off line.
  - b. In the event of communications failure between the Central Station and a Location, there shall be no degradation in operations at the Controllers at that Location. The Controllers at each Location shall be connected to a memory buffer with a capacity to store up to 10,000 events; there shall be no loss of transactions in system history files until the buffer overflows.
  - c. Buffered events shall be handled in a first-in-first-out mode of operation.
4. Individual Controller Operation:
  - a. Controllers shall transmit alarms, status changes, and other data to the Central Station when communications circuits are operable. If communications are not available, Controllers shall function in a stand-alone mode and operational data, including the status and alarm data normally transmitted to the Central Station, shall be stored for later transmission to the Central Station. Storage

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capacity for the latest 1024 events shall be provided at each Controller.

- b. Card-reader ports of a Controller shall be custom configurable for at least 120 different card-reader or keypad formats. Multiple reader or keypad formats may be used simultaneously at different Controllers or within the same Controller.
  - c. Controllers shall provide a response to card-readers or keypad entries in less than 0.25 seconds, regardless of system size.
  - d. Controllers that are reset, or powered up from a nonpowered state, shall automatically request a parameter download and reboot to its proper working state. This shall happen without any operator intervention.
  - e. Initial Startup: When Controllers are brought on-line, database parameters shall be automatically downloaded to them. After initial download is completed, only database changes shall be downloaded to each Controller.
  - f. Failure Mode: On failure for any reason, Controllers shall perform an orderly shutdown and force Controller outputs to a predetermined failure mode state, consistent with the failure modes shown and the associated control device.
  - g. Startup After Power Failure: After power is restored, startup software shall initiate self-test diagnostic routines, after which Controllers shall resume normal operation.
  - h. Startup After Controller Failure: On failure, if the database and application software are no longer resident, Controllers shall not restart, but shall remain in the failure mode until repaired. If database and application programs are resident, Controllers shall immediately resume operation. If not, software shall be restored automatically from the Central Station.
5. Communications Monitoring:
- a. System shall monitor and report TCP/IP communication status of each Location.
  - b. Communication status window shall display which Controllers are currently communicating, a total count of missed polls since midnight, and which Controller last missed a poll.
  - c. Communication status window shall show the type of CPU, the type of I/O board, and the amount of RAM memory for each Controller.

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6. Operating systems shall include a real-time clock function that maintains seconds, minutes, hours, day, date, and month. The real-time clock shall be automatically synchronized with the Central Station at least once a day to plus or minus 10 seconds. The time synchronization shall be automatic, without operator action and without requiring system shutdown.

**F. PC-to-Controller Communications:**

1. Central-station or workstation communications shall use the following:
  - a. Direct connection using serial ports of the PC.
  - b. TCP/IP LAN network interface cards.
  - c. Dial-up modems for connections to Locations.
2. Serial Port Configuration: Each serial port used for communications shall be individually configurable for "direct communications," "modem communications incoming and outgoing," or "modem communications incoming only"; or as an ASCII output port.
3. Multiport Communications Board: Use if more than two serial ports are needed.
  - a. Expandable and modular design. Use a 4-, 8-, or 16-serial port configuration that is expandable to 32 or 64 serial ports.
  - b. Connect the first board to an internal PCI bus adapter card.
4. Direct serial, TCP/IP, and dial-up communications shall be alike in the monitoring or control of system, except for the connection that must first be made to a dial-up Location.
5. TCP/IP network interface card shall have an option to set the poll frequency and message response time-out settings.
6. PC-to-Controller and Controller-to-Controller communications (direct, dial-up, or TCP/IP) shall use a polled-communication protocol that checks sum and acknowledges each message. All communications shall be verified and buffered and retransmitted if not acknowledged.

**G. Direct Serial or TCP/IP PC-to-Controller Communications:**

1. Communication software on the PC shall supervise the PC-to-Controller communications link.
2. Loss of communications to any Controller shall result in an alarm at all PCs running the communications software.

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3. When communications are restored, all buffered events shall automatically upload to the PC, and any database changes shall be automatically sent to the Controller.

H. Controller-to-Controller Communications:

1. Controller-to-Controller Communications: RS-485, 4-wire, point-to-point, regenerative (repeater) communications network methodology.
2. RS-485 communications signal shall be regenerated at each Controller.

I. Anti-Passback:

1. System shall have global and local anti-passback features, selectable by Location. System shall support hard and soft anti-passback.
2. Hard Anti-Passback: Once a credential holder is granted access through a reader with one type of designation (IN or OUT), the credential holder may not pass through that type of reader designation until the credential holder passes through a reader of opposite designation.
3. Soft Anti-Passback: Should a violation of the proper IN or OUT sequence occur, access shall be granted, but a unique alarm shall be transmitted to the control station, reporting the credential holder and the door involved in the violation. A separate report may be run on this event.
4. Timed Anti-Passback: A Controller capability that prevents an access code from being used twice at the same device (door) within a user-defined amount of time.
5. Provide four separate zones per Location that can operate without requiring interaction with the host PC (done at Controller). Each reader shall be assignable to one or all four anti-passback zones. In addition, each anti-passback reader can be further designated as "Hard," "Soft," or "Timed" in each of the four anti-passback zones. The four anti-passback zones shall operate independently.
6. The anti-passback schemes shall be definable for each individual door.
7. The Master Access Level shall override anti-passback.
8. System shall have the ability to forgive (or reset) an individual credential holder or the entire credential holder population anti-passback status to a neutral status.

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J. System Redundancy & High Availability: The system shall provide multiple levels of communications redundancy and failover for all PACS hosted controllers, digital video recorders, and client workstations. The PACS shall be capable of automatically re-routing communications to alternate computers across the system without operator intervention.

1. PACS system configuration with a single application/ database server shall provide at a minimum the following redundancy and failover capability:

- a. The PACS shall provide communications redundancy and failover for network-attached devices. Each network attached device shall have one or more alternative communication sever(s) that can provide hosting in case of primary communications server failure.
- b. In case of primary communications server failure, the system shall automatically re-route network-attached devices to their designated backup communications servers to allow continuous system operations without loss of alarm and event transaction processing during failover.
- c. Network-attached devices which transition to backup communications servers, shall be able to be redirected back to their default primary servers, once the primary communications servers have been restored.

**2.4 SURGE AND TAMPER PROTECTION**

A. Surge Protection: Protect components from voltage surges originating external to equipment housing and entering through power, communication, signal, control, or sensing leads. Include surge protection for external wiring of each conductor-entry connection to components.

1. Minimum Protection for Power Connections 120 V and More: Auxiliary panel suppressors complying with requirements in Division 26 Section "Transient-Voltage Suppression for Low-Voltage Electrical Power Circuits."
2. Minimum Protection for Communication, Signal, Control, and Low-Voltage Power Connections: Comply with requirements in Division 26 Section "Transient-Voltage Suppression for Low-Voltage Electrical Power Circuits" as recommended by manufacturer for type of line being protected.

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- B. Tamper Protection: Tamper switches on enclosures, control units, pull boxes, junction boxes, cabinets, and other system components shall initiate a tamper-alarm signal when unit is opened or partially disassembled. Control-station control-unit alarm display shall identify tamper alarms and indicate locations.

**2.5 CONTROLLERS**

- A. Controllers: Intelligent peripheral control unit, complying with UL 294, that stores time, date, valid codes, access levels, and similar data downloaded from the Central Station or workstation for controlling its operation.
- B. Subject to compliance with requirements in this Article, manufacturers may use multipurpose Controllers.
- C. Battery Backup: Sealed, lead acid; sized to provide run time during a power outage of 90 minutes, complying with UL 924.
- D. Alarm Annunciation Controller:
1. The Controller shall automatically restore communication within 10 seconds after an interruption with the field device network with dc line supervision on each of its alarm inputs.
    - a. Inputs: Monitor dry contacts for changes of state that reflect alarm conditions. Provides at least eight alarm inputs, which are suitable for wiring as normally open or normally closed contacts for alarm conditions.
    - b. Alarm-Line Supervision:
      - 1) Supervise the alarm lines by monitoring each circuit for changes or disturbances in the signal, and for conditions as described in UL 1076 for line security equipment using dc change measurements. System shall initiate an alarm in response to an abnormal current, which is a dc change of 5 percent or more for longer than 500 ms.
      - 2) Transmit alarm-line-supervision alarm to the Central Station during the next interrogation cycle after the abnormal current condition.
    - c. Outputs: Managed by Central Station software.
  2. Auxiliary Equipment Power: A GFI service outlet inside the Controller enclosure.
  3. Manufacturer: HIRSCH M8N2.

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**E. Entry-Control Controller:**

1. Function: Provide local entry-control functions including one- and two-way communications with access-control devices such as card readers, keypads, biometric personal identity verification devices, door strikes, magnetic latches, gate and door operators, and exit push-buttons.
  - a. Operate as a stand-alone portal Controller using the downloaded database during periods of communication loss between the Controller and the field-device network.
  - b. Accept information generated by the entry-control devices; automatically process this information to determine valid identification of the individual present at the portal:
    - 1) On authentication of the credentials or information presented, check privileges of the identified individual, allowing only those actions granted as privileges.
    - 2) Privileges shall include, but not be limited to, time of day control, day of week control, group control, and visitor escort control.
  - c. Maintain a date-, time-, and Location-stamped record of each transaction. A transaction is defined as any successful or unsuccessful attempt to gain access through a controlled portal by the presentation of credentials or other identifying information.
2. Inputs:
  - a. Data from entry-control devices; use this input to change modes between access and secure.
  - b. Database downloads and updates from the Central Station that include enrollment and privilege information.
3. Outputs:
  - a. Indicate success or failure of attempts to use entry-control devices and make comparisons of presented information with stored identification information.
  - b. Grant or deny entry by sending control signals to portal-control devices and mask intrusion alarm annunciation from sensors stimulated by authorized entries.

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- c. Maintain a date-, time-, and Location-stamped record of each transaction and transmit transaction records to the Central Station.
- d. Door Prop Alarm: If a portal is held open for longer than 20 seconds, alarm sounds.
- 4. With power supplies sufficient to power at voltage and frequency required for field devices and portal-control devices.
- 5. Data Line Problems: For periods of loss of communications with Central Station, or when data transmission is degraded and generating continuous checksum errors, the Controller shall continue to control entry by accepting identifying information, making authentication decisions, checking privileges, and controlling portal-control devices.
  - a. Store up to 1000 transactions during periods of communication loss between the Controller and access-control devices for subsequent upload to the Central Station on restoration of communication.
- 6. Controller Power: NFPA 70, Class II power supply transformer, with 12- or 24-V ac secondary, backup battery and charger.
  - a. Backup Battery: Premium, valve-regulated, recombinant-sealed, lead-calcium battery; spill proof; with a full 1-year warranty and a pro rata 19-year warranty. With single-stage, constant-voltage-current, limited battery charger, comply with battery manufacturer's written instructions for battery terminal voltage and charging current recommendations for maximum battery life.
  - b. Backup Battery: Valve-regulated, recombinant-sealed, lead-acid battery; spill proof. With single-stage, constant-voltage-current, limited battery charger, comply with battery manufacturer's written instructions for battery terminal voltage and charging current recommendations for maximum battery life.
  - c. Backup Power Supply Capacity: 90 minutes of battery supply. Submit battery and charger calculations.
  - d. Power Monitoring: Provide manual dynamic battery load test, initiated and monitored at the control center; with automatic disconnection of the Controller when battery voltage drops below Controller limits. Report by using local Controller-mounted LEDs and by communicating status to Central Station. Indicate normal



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power on and battery charger on trickle charge. Indicate and report the following:

- 1) Trouble Alarm: Normal power off load assumed by battery.
- 2) Trouble Alarm: Low battery.
- 3) Alarm: Power off.

7. Manufacturer: Hirsch DTLM-2.

**2.6 CARD READERS**

- A. Power: Card reader shall be powered from its associated Controller, including its standby power source.
- B. Response Time: Card reader shall respond to passage requests by generating a signal that is sent to the Controller. Response time shall be 800 ms or less, from the time the card reader finishes reading the credential card until a response signal is generated.
- C. Enclosure: Suitable for surface, semiflush, or pedestal mounting. Mounting types shall additionally be suitable for installation in the following locations:
  1. Indoors, controlled environment.
  2. Indoors, uncontrolled environment.
  3. Outdoors, with built-in heaters or other cold-weather equipment to extend the operating temperature range as needed for operation at the site.
- D. Display: LED or other type of visual indicator display shall provide visual and audible status indications and user prompts. Indicate power on/off, whether user passage requests have been accepted or rejected, and whether the door is locked or unlocked.
- E. Shall be utilized for controlling the locking hardware on a door and allows for reporting back to the main control panel with the time/date the door was accessed, the name of the person accessing the point of entry, and its location.
- F. Will be fully programmable and addressable, locally and remotely, and hardwired to the system.
- G. Shall be individually home run to the main panel.
- H. Shall be installed in a manner that they comply with:
  1. The Uniform Federal Accessibility Standards (UFAS)
  2. The Americans with Disabilities Act (ADA)
  3. The ADA Standards for Accessible Design

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- I. Shall support a variety of card readers that must encompass a wide functional range. The PACS may combine any of the card readers described below for installations requiring multiple types of card reader capability (i.e., card only, card and/or PIN, card and/or biometrics, card and/or pin and/or biometrics, supervised inputs, etc.). These card readers shall be available in the approved technology to meet FIPS 201, and is ISO 14443 A or B, ISO/IEC 7816 compliant. The reader output can be Wiegand, RS-22, 485 or TCP/IP.
- J. Shall be housed in an aluminum bezel with a wide lead-in for easy card entry.
- K. Shall contain read head electronics, and a sender to encode digital door control signals.
- L. LED's shall be utilized to indicate card reader status and access status.
- M. Shall be able to support a user defined downloadable off-line mode of operation (e.g. locked, unlocked), which will go in effect during loss of communication with the main control panel.
- N. Shall provide audible feedback to indicate access granted/denied decisions. Upon a card swipe, two audible tones or beeps shall indicate access granted and three tones or beeps shall indicate access denied. All keypad buttons shall provide tactile audible feedback.
- O. Shall have a minimum of two programmable inputs and two programmable outputs.
- P. All card readers that utilize keypad controls along with a reader and shall meet the following specifications:
  - 1. Entry control keypads shall use a unique combination of alphanumeric and other symbols as an identifier. Keypads shall contain an integral alphanumeric/special symbols keyboard with symbols arranged in ascending ASCII code ordinal sequence. Communications protocol shall be compatible with the local processor.
- Q. Shall include a Light Emitting Diode (LED) or other type of visual indicator display and provide visual or visual and audible status indications and user prompts. The display shall indicate power on/off, and whether user passage requests have been accepted or rejected. The design of the keypad display or keypad enclosure shall limit the maximum horizontal and vertical viewing angles of the keypad. The maximum horizontal viewing angle shall be plus and minus five (5)

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degrees or less off a vertical plane perpendicular to the plane of the face of the keypad display. The maximum vertical viewing angle shall be plus and minus 15 degrees or less off a horizontal plane perpendicular to the plane of the face of the keypad display.

1. Shall respond to passage requests by generating a signal to the local processor. The response time shall be 800 milliseconds or less from the time the last alphanumeric symbol is entered until a response signal is generated.
2. Shall be powered from the source as designed and shall not dissipate more than 150 Watts.
3. Shall be suitable for surface, semi-flush, pedestal, or weatherproof mounting as required.
4. Shall provide a means for users to indicate a duress situation by entering a special code.

**R. PIV Contact Card Reader**

1. Application Protocol Data Unit (APDU) Support: At a minimum, the contact interface shall support all card commands for contact based access specified in Section 7, End-point PIV Card Application Card Command Interface of SP 800-73-1, Interfaces for Personal Identity Verification.
2. Buffer Size: The reader must contain a buffer large enough to receive the maximum size frame permitted by International Organization for Standardization International Electrotechnical Commission (ISO/IEC) 7816-3:1997, Section 9.4.
3. Programming Voltage: PIV Readers shall not generate a Programming Voltage.
4. Support for Operating Class: PIV Readers shall support cards with Class A Vccs as defined in ISO/IEC 7816-3:1997 and ISO/IEC 7816-3:1997/Amd 1:2002.
5. Retrieval Time: Retrieval time<sup>1</sup> for 12.5 kilobytes (KB) of data through the contact interface of the reader shall not exceed 2.0 seconds.
6. Transmission Protocol: The PIV Reader shall support both the character-based T=0 protocol and block-based T=1 protocol as defined in ISO/IEC 7816-3:1997.

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7. Support for PPS Procedure: The reader shall support Protocol and Parameters Selection (PPS) procedure by having the ability to read character TA1 of the Answer to Reset (ATR) sent by the card as defined in ISO/IEC 7816-3:1997.

S. Contactless Smart Cards and Readers:

1. Smart card readers shall read credential cards whose characteristics of size and technology meet those defined by ISO/IEC 7816, 14443, 15693.
2. The readers shall have "flash" download capability to accommodate card format changes.
3. The card reader shall have the capability of reading the card data and transmitting the data to the main monitoring panel.
4. The card reader shall be contactless and meet or exceed the following technical characteristics:
  - a. Data Output Formats: FIPS 201 low outputs the FASC-N in an assortment of Wiegand bit formats from 40 - 200 bits. FIPS 201 medium outputs a combination FASC-N and HMAC in an assortment of Wiegand bit formats from 32 - 232 bits. All Wiegand formats or the upgradeability from Low to Medium Levels can be field configured with the use of a command card.
  - b. FIPS 201 readers shall be able to read, but not be limited to, DESfire and iCLASS cards.
  - c. Reader range shall comply with ISO standards 7816, 14443, and 15693, and also take into consideration conditions, are at a minimum 1" to 2" (2.5 - 5 cm).
  - d. APDU Support: At a minimum, the contactless interface shall support all card commands for contactless based access specified in Section 7, End-point PIV Card Application Card Command Interface of SP 800-73-1, Interfaces for Personal Identity Verification.
  - e. Buffer Size: The reader shall contain a buffer large enough to receive the maximum size frame permitted by ISO/IEC 7816-3, Section 9.4.
  - f. ISO 14443 Support: The PIV Reader shall support parts (1 through 4) of ISO/IEC 14443 as amended in the References of this publication.

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- g. Type A and B Communication Signal Interfaces: The contactless interface of the reader shall support both the Type A and Type B communication signal interfaces as defined in ISO/IEC 14443-2:2001.
  - h. Type A and B Initialization and Anti-Collision The contactless interface of the reader shall support both Type A and Type B initialization and anti-collision methods as defined in ISO/IEC 14443-3:2001.
  - i. Type A and B Transmission Protocols: The contactless interface of the reader shall support both Type A and Type B transmission protocols as defined in ISO/IEC 14443-4:2001.
  - j. Retrieval Time: Retrieval time for 4 KB of data through the contactless interface of the reader shall not exceed 2.0 seconds.
  - k. Transmission Speeds: The contactless interface of the reader shall support bit rates of  $fc/128$  (~106 kbits/s),  $fc/64$  (~212 kbits/s), and configurable to allow activation/deactivation.
  - l. Readability Range: The reader shall not be able to read PIV card more than 10cm(4inch) from the reader
5. Manufacturer: Hirsch DS47L-SSP-HID.

**2.7 KEYPADS**

- A. Designed for use with unique combinations of alphanumeric and other symbols as an Identifier. Keys of keypads shall contain an integral alphanumeric/special symbol keyboard with symbols arranged in random scrambled order. Communications protocol shall be compatible with Controller.
- 1. Keypad display or enclosure shall limit viewing angles of the keypad as follows:
    - a. Maximum Horizontal Viewing Angle: 5 degrees or less off in either direction of a vertical plane perpendicular to the plane of the face of the keypad display.
    - b. Maximum Vertical Viewing Angle: 15 degrees or less off in either direction of a horizontal plane perpendicular to the plane of the face of the keypad display.
  - 2. Duress Codes: Provide duress situation indication by entering a special code.

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**2.8 SYSTEM SENSORS AND RELATED EQUIPMENT**

A. The PACS (Physical Access Control System) and related Equipment provided by the Contractor shall meet or exceed the following performer specifications:

B. Request to Exit Detectors:

1. Passive Infrared Request to Exit Motion Detector (REX PIR) (1) The Contractor shall provide a surface mounted motion detector to signal the physical access control system request to exit input. The motion detector shall be a passive infrared sensor designed for wall or ceiling mounting 2134 to 4572 mm (7 to 15 ft) height. The detector shall provide two (2) form "C" (SPDT) relays rated one (1) Amp. @ 30 VDC for DC resistive loads. The detectors relays shall be user adjustable with a latch time from 1-60 seconds. The detector shall also include a selectable relay reset mode to follow the timer or absence of motion. The detection pattern shall be adjustable plus or minus fourteen ( $\pm 14$ ) degrees. The detector shall operate on 12 VDC with approximately 26 mA continuous current draw. The detector shall have an externally visible activation LED. The motion detector shall measure approximately 38 mm H x 158 mm W x 38 mm D (1.5 x 6.25 x 1.5 in). The detector shall be immune to radio frequency interference. The detector shall not activate or set-up on critical frequencies in the range 26 to 950 Megahertz using a 50 watt transmitter located 30.5 cm (1 ft) from the unit or attached wiring. The detector shall be available on gray or black enclosures. The color of the housing shall be coordinated with the surrounding surface.

C. Delayed Egress (DE):

1. General:

- a. The delay egress locking hardware shall provide a method to secure emergency exits and provide an approved delayed emergency exit method. The package shall be Underwriters Laboratories listed as a delay egress-locking device. The delay egress device shall be available to support configurations with both rated and non-rated fire doors. The delay egress device shall comply with Life Safety Codes (NFPA-101, BOCA) as it applies to special locking arrangements for delay egress locks. Unless specifically identified as a non-fire rated opening, all doors shall be

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equipped with fire rated door hardware. The Contractor shall be responsible for providing all equipment and installation to provide a fully functioning system. Need to amend to use crashbars type mechanical release switches.

2. The delay-locking device shall include all of the following features:

a. Delay Egress Mode:

1) The delayed egress device shall be a SDC 101V Series Exit Check with wall mounted control module. Upon activation of an approved panic bar the delay locking device shall begin a delay sequence of 30 seconds; a flush mounted wall LED panel adjacent to the door will indicate initiation of the countdown time. During the 30 second delay period, a local sounding device shall annunciate a tone activation of the delay cycle and verbal exit instructions. At the end of the delay cycle the locking device shall unlock and allow free egress. The reset of the local sounding device shall be user definable and include options to select either local sound until silenced by reset or local sounder silenced upon opening of the door. Unless otherwise indicated the local delay sounder shall be silenced upon opening of the door. The SDC's device trigger output shall be connected to the SMS DGP alarm panel for pre-activation warning. The contractor shall specify the bond sensor option when ordering the delayed egress hardware; this output shall be wired to the SMS DGP to activate an alarm if the door does not lock. Use of reset panel not top mounted device.

2) Delayed egress doors will have bond sensors.

3) Delayed egress activation shall also trigger CCTV call -up.

b. Fire Alarm Mode:

1) Upon activation of the facility's fire evacuation and water flow alarm signal the delay locking devices shall immediately unlock and provide free egress. The Contractor shall provide any required fire alarm relays or interface devices.

c. Reset Mode:

1) The delay egress device shall be manually reset by the Delayed Egress controller located at the door via key switch.

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- 2) The delay egress device shall automatically reset upon fire alarm system reset.
- 3) The delayed egress shall be resettable through the SMS.
- d. The Contractor shall provide a Master Open Switch for all the facility's delayed egress hardware, with protective cover and permanent labeling in the Unit Control Room. The switch shall be wired into the fire alarm system to activate the evacuation alarms. When the switch is pressed all delayed egress or evacuation doors shall unlock and generate an alarm at the security console monitor showing and recording time and date of when the switch was pressed. The contractor is responsible for coordinating the wiring and connection with the fire alarm contactor. The Master Open Switch shall be linked to the fire alarm panel for the release of doors locks.
- e. Each individual delayed egress door shall have the ability to unlock through a manual action on the SMS.
- f. Unless otherwise indicated the Contractor shall provide all of the above reset methods for each door. All signs will meet the latest ADA requirements.
- g. Signs:
  - 1) The delay egress package shall be provided with a warning sign complying with local code requirements. The warning sign shall be attached to the interior side of the controlled door. The sign shall be located on the interior side of the door above and within 304 mm (12 in) of the panic bar. The sign shall read:  
EMERGENCY EXIT  
PUSH UNTIL  
ALARM SOUNDS  
DOOR CAN BE OPENED,  
IN 30 SECONDS.
  - 2) Signs shall be coordinated and comply with the building's existing sign specifications. Signs shall include grade 2 Braille.
  - 3) Signs shall meet the current ADA requirements.
  - 4) In instances of code and specification conflicts, the life safety code requirement shall prevail.



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- 5) The Division 10 Contractor shall provide samples for approval with their submittal package.
3. Physical Access Control Interface
    - a. The delay egress device shall be capable of interface with card access control systems.
    - b. The system shall include a bypass feature that is activated via a dry contact relay output from the physical access control system. This bypass shall allow authorized personnel to pass through the controlled portal without creating an alarm condition or activating the delay egress cycle. The bypass shall include internal electronic shunts or door switches to prevent activation (re-arming) until the door returns to the closed position. An unused access event shall not cause a false alarm and shall automatically rearm the delay egress lock upon expiration of the programmed shunt time. The delay egress physical access control interface shall support extended periods of automated and/or manual lock and unlock cycles.

**E. Crash Bar:**

1. Emergency Exit with Alarm (Panic):
  - a. Entry control portals shall include panic bar emergency exit hardware as designed.
  - b. Panic bar emergency exit hardware shall provide an alarm shunt signal to the PACS and SMS.
  - c. The panic bar shall include a conspicuous warning sign with one (1) inch (2.5 cm) high, red lettering notifying personnel that an alarm will be annunciated if the panic bar is operated.
  - d. Operation of the panic bar hardware shall generate an intrusion alarm that reports to both the SMS and Intrusion Detection System. The use of a micro switch installed within the panic bar shall be utilized for this.
  - e. The panic bar shall utilize a fully mechanical connection only and shall not depend upon electric power for operation.
  - f. The panic bar shall be compatible with mortise or rim mount door hardware and shall operate by retracting the bolt manually by either pressing the panic bar or with a key by-pass. Refer to Section 2.2.I.9 for key-bypass specifications.

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g. Normal Exit:

- 1) Entry control portals shall include panic bar non-emergency exit hardware as designed.
- 2) Panic bar non-emergency exit hardware shall be monitored by and report to the SMS.
- 3) Operation of the panic bar hardware shall not generate a locally audible or an intrusion alarm within the IDS.
- 4) When exiting, the panic bar shall depend upon a mechanical connection only. The exterior, non-secure side of the door shall be provided with an electrified thumb latch or lever to provide access after the credential I.D. authentication by the SMS.
- 5) The panic bar shall be compatible with mortise or rim mount door hardware and shall operate by retracting the bolt manually by either pressing the panic bar or with a key bypass. Refer to Section 2.2.I.9 for key-bypass specifications. The strikes/bolts shall include a micro switch to indicate to the system when the bolt is not engaged or the strike mechanism is unlocked. The signal switches shall report a forced entry to the system in the event the door is left open or accessed without the identification credentials.

F. Key Bypass:

1. Shall be utilized for all doors that have a mortise or rim mounted door hardware.
2. Each door shall be individually keyed with one master key per secured area.
3. Cylinders shall be six (6)-pin and made of brass or equivalent. Keys for the cylinders shall be constructed of solid material and produced and cut by the same distributor. Keys shall not be purchased, cut, and supplied by multiple dealers.
4. All keys shall have a serial number cut into the key. No two serial numbers shall be the same.
5. All keys and cylinders shall be stored in a secure area that is monitored by the Intrusion Detection System.

G. Automatic Door Opener and Closer:

1. Shall be low energy operators.

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2. Door closing force shall be adjustable to ensure adequate closing control.
3. Shall have an adjustable back-check feature to cushion the door opening speed if opened violently.
4. Motor assist shall be adjustable from 0 to 30 seconds in five (5) second increments. Motor assist shall restart the time cycle with each new activation of the initiating device.
5. Unit shall have a three-position selector mode switch that shall permit unit to be switched "ON" to monitor for function activation, switched to "H/O" for indefinite hold open function or switched to "OFF," which shall deactivate all control functions but will allow standard door operation by means of the internal mechanical closer.
6. Door control shall be adjustable to provide compliance with the requirements of the Americans with Disabilities Act (ADA) and ANSI standards A117.1.
7. All automatic door openers and closers shall:
  - a. Meet UL standards.
  - b. Be fire rated.
  - c. Have push and go function to activate power operator or power assist function.
  - d. Have push button controls for setting door close and door open positions.
  - e. Have open obstruction detection and close obstruction detection built into the unit.
  - f. Have door closer assembly with adjustable spring size, back-check valve, sweep valve, latch valve, speed control valve and pressure adjustment valve to control door closing.
  - g. Have motor start-up delay, vestibule interface delay; electric lock delay and door hold open delay up to 30 seconds. All operators shall close door under full spring power when power is removed.
  - h. Are to be hard wired with power input of 120 VAC, 60Hz and connected to a dedicated circuit breaker located on a power panel reserved for security equipment.
- H. Door Status Indicators:
  1. Shall monitor and report door status to the SMS.

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**2. Door Position Sensor:**

- a. Shall provide an open or closed indication for all doors operated on the PACS and report directly to the SMS.
- b. Shall also provide alarm input to the Intrusion Detection System for all doors operated by the PACS and all other doors that require monitoring by the intrusion detection system.
- c. Switches for doors operated by the PACS shall be double pole double throw (DPDT). One side of the switch shall monitor door position and the other side if the switch shall report to the intrusion detection system. For doors with electromagnetic locks a magnetic bonding sensor (MBS) can be used in place of one side of a DPDT switch, in turn allowing for the use of a single pole double throw (SPDT) switch in it place of a DPDT switch.
- d. Switches for doors not operated by the PACS shall be SPDT and report directly to the IDS.
- e. Shall be surface or flush mounted and wide gap with the ability to operate at a maximum distance of up to 2" (5 cm).

**2.9 PUSH BUTTON SWITCHES**

A. Push-Button Switches: Momentary-contact back-lighted push buttons, with stainless-steel switch enclosures.

**1. Electrical Ratings:**

- a. Minimum continuous current rating of 10 A at 120 V ac or 5 A at 240-V ac.
- b. Contacts that will make 720 VA at 60 A and that will break at 720 VA at 10 A.

2. Enclosures: Flush or surface mounting. Push buttons shall be suitable for flush mounting in the switch enclosures.

3. Enclosures shall additionally be suitable for installation in the following locations:

- a. Indoors, controlled environment.
- b. Indoors, uncontrolled environment.
- c. Outdoors.

4. Power: Push-button switches shall be powered from their associated Controller, using dc control.

**2.10 PORTAL CONTROL DEVICES**

A. Shall be used to assist the PACS.

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- B. Such devices shall:
  - 1. Provide a means of monitoring the doors status.
  - 2. Allow for exiting a space via either a push button, request to exit, or panic/crash bar.
  - 3. Provide a means of override to the PACS via a keypad or key bypass.
  - 4. Assist door operations utilizing automatic openers and closures.
  - 5. Provide a secondary means of access to a space via a keypad.
- C. Shall be connected to and monitored by the main PACS panel.
- D. Shall be installed in a manner that they comply with:
  - 1. The Uniform Federal Accessibility Standards (UFAS)
  - 2. The Americans with Disabilities Act (ADA)
  - 3. The ADA Standards for Accessible Design
- E. Shall provide a secondary means of physical access control within a secure area.
- F. Push-Button Switches:
  - 1. Shall be momentary contact, back lighted push buttons, and stainless steel switch enclosures for each push button as shown. Buttons are to be utilized for secondary means of releasing a locking mechanism.
    - a. In an area where a push button is being utilized for remote access of the locking device then no more than two (2) buttons shall operate one door from within one secure space. Buttons will not be wired in series with one other.
    - b. In an area where locally stationed guards control entry to multiple secure points via remote switches. An interface board shall be designed and constructed for only the amount of buttons it shall house. These buttons shall be flush mounted and clearly labeled for ease of use. All buttons shall be connected to the PACS and SMS system for monitoring purposes.
    - c. Shall have double-break silver contacts that will make 720 VA at 60 amperes and break 720 VA at 10 amperes.
- G. Entry Control Devices:
  - 1. Shall be hardwired to the PACS main control panel and operated by either a card reader or a biometric device via a relay on the main control panel.
  - 2. Shall be fail-safe in the event of power failure to the PACS system.
  - 3. Shall operate at 24 VCD, with the exception of turnstiles and be powered by a separate power supply dedicated to the door control

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- system. Each power supply shall be rated to operate a minimum of two doors simultaneously without error to the system or overload the power supply unit.
4. Shall have a diode or metal-oxide varistor (MOV) to protect the controller and power supply from reverse current surges or back-check.
  5. Electric Strikes/Bolts: Shall be:
    - a. Made of heavy-duty construction and tamper resistant design.
    - b. Tested to over one million cycles.
    - c. Rated for a minimum of 1000 lbs. holding strength.
    - d. Utilize an actuating solenoid for the strike/bolt. The solenoid shall move from fully open to fully closed position and back in not more than 500 milliseconds and be rated for continuous duty.
    - e. Utilize a signal switch that will indicate to the system if the strike/bolt is not engaged or is unlocked when it should be secured.
    - f. Flush mounted within the door frame.
  6. Electric Mortise Locks: Shall be installed within the door and an electric transfer hinge shall be utilized to allow the wires to be transferred from the door frame to the lock. If utilized with a double door then the lock shall be installed inside the active leaf. Electric Mortise Locks shall:
    - a. These locks shall be provided and installed by the Division 8 "DOOR HARDWARE" Contractor.
  7. Electromagnetic Locks:
    - a. These locks shall be without mechanical linkage utilizing no moving parts, and securing the door to its frame solely on electromagnetic force.
    - b. Shall be comprised of two pieces, the mag-lock and the door plate. The electromagnetic locks shall be surface mounted to the door frame and the door plate shall be surface mounted to the door.
    - c. Ensure a diode is installed in line with the DC voltage supplying power to the unit in order to prevent back-check on the system when the electromagnetic lock is powered.

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- e. Electromagnetic locks shall meet the following minimum technical characteristics:

Operating Voltage		24 VDC
Current Draw		.5A
Holding Force	Swing Doors	675 kg (1500 lbs)
	Sliding Doors	225 kg (500 lbs)

## **2.11 INTERFACES**

A. CCTV System Interface:

1. An RS32 Ethernet interface associated driver, and controller shall be provided for connection of the SMS Central Computer to the CCTV Alarm interface and switcher. The interface shall provide alarm data to the CCTV Alarm interface for automatic camera call-up. If required the Security Contractor shall be responsible for programming the command strings into the SMS Server.

B. Power Supplies:

1. Shall be UL rated and able to adequately power (enter number) entry control devices on a continuous base without failure.
2. Shall meet the following minimum technical characteristics:

INPUT POWER	110 VAC 60 HZ (enter amperage)A
OUTPUT VOLTAGE	12 VDC Nominal (13.8 VDC) 24 VDC Nominal (27.6 VDC) Filtered and Regulated
BATTERY	Dependant on Output Voltage shall provide up to <__> Ah
OUTPUT CURRENT	[10] amp max. [@ 13.8] VDC [5] amp max. [@ 27.6] VDC
PRIMARY FUSE SIZE	6.3 amp (non-removable)
BATTERY FUSE SIZE	12 amp, 3AG
CHARGING CIRCUIT	Built-in standard

## **2.12 WIRES AND CABLES**

- A. Refer to section 280513 "CONDUCTORS AND CABLES FOR ELECTRONIC SAFETY AND SECURITY".

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**PART 3 - EXECUTION**

**3.1 GENERAL**

- A. The Contractor shall install all system components and appurtenances in accordance with the manufacturers' instructions, ANSI C2, and shall furnish all necessary interconnections, services, and adjustments required for a complete and operable system as specified. Control signals, communications, and data transmission lines grounding shall be installed as necessary to preclude ground loops, noise, and surges from affecting system operation. Equipment, materials, installation, workmanship, inspection, and testing shall be in accordance with manufacturers' recommendations and as modified herein.
- B. Consult the manufacturers' installation manuals for all wiring diagrams, schematics, physical equipment sizes, etc., before beginning system installation. Refer to the Riser/Connection diagram for all schematic system installation/termination/wiring data.
- C. All equipment shall be attached to walls and ceiling/floor assemblies and shall be held firmly in place (e.g., sensors shall not be supported solely by suspended ceilings). Fasteners and supports shall be adequate to support the required load.

**3.2 CURRENT SITE CONDITIONS**

- A. The Contractor shall visit the site and verify that site conditions are in agreement with the design package. The Contractor shall report all changes to the site or conditions which will affect performance of the system to the Resident Engineer in a report as defined in paragraph Group II Technical Data Package. The Contractor shall not take any corrective action without written permission from the Resident Engineer.

**3.3 EXAMINATION**

- A. Examine pathway elements intended for cables. Check raceways, cable trays, and other elements for compliance with space allocations, installation tolerances, hazards to cable installation, and other conditions affecting installation.
- B. Examine roughing-in for LAN and control cable conduit systems to PCs, Controllers, card readers, and other cable-connected devices to verify actual locations of conduit and back boxes before device installation.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.



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**3.4 PREPARATION**

- A. Comply with recommendations in SIA CP-01.
- B. Comply with EIA/TIA-606B, "Administration Standard for the Telecommunications Infrastructure of Commercial Buildings."
- C. Obtain detailed Project planning forms from manufacturer of access-control system; develop custom forms to suit Project. Fill in all data available from Project plans and specifications and publish as Project planning documents for review and approval.
  - 1. Record setup data for control station and workstations.
  - 2. For each Location, record setup of Controller features and access requirements.
  - 3. Propose start and stop times for time zones and holidays, and match up access levels for doors.
  - 4. Set up groups, linking, and list inputs and outputs for each Controller.
  - 5. Assign action message names and compose messages.
  - 6. Set up alarms. Establish interlocks between alarms, intruder detection, and video surveillance features.
  - 7. Prepare and install alarm graphic maps.
  - 8. Develop user-defined fields.
  - 9. Develop screen layout formats.
  - 10. Propose setups for guard tours and key control.
  - 11. Discuss badge layout options; design badges.
  - 12. Complete system diagnostics and operation verification.
  - 13. Prepare a specific plan for system testing, startup, and demonstration.
  - 14. Develop acceptance test concept and, on approval, develop specifics of the test.
  - 15. Develop cable and asset management system details; input data from construction documents. Include system schematics and Technical Drawings.
- D. In meetings with Architect and Resident Engineer, present Project planning documents and review, adjust, and prepare final setup documents. Use final documents to set up system software.

**3.5 CABLING**

- A. Comply with NECA 1, "Good Workmanship in Electrical Contracting."

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- B. Install cables and wiring according to requirements in Division 28 Section "Conductors and Cables for Electronic Safety and Security."
- C. Wiring Method: Install wiring in raceway and cable tray except within consoles, cabinets, desks, and counters. Conceal raceway and wiring except in unfinished spaces.
- D. Wiring Method: Install wiring in raceway and cable tray except within consoles, cabinets, desks, and counters and except in accessible ceiling spaces and in gypsum board partitions where unenclosed wiring method may be used. Use NRTL-listed plenum cable in environmental air spaces, including plenum ceilings. Conceal raceway and cables except in unfinished spaces.
- E. Install LAN cables using techniques, practices, and methods that are consistent with Category 6 rating of components and that ensure Category 6 performance of completed and linked signal paths, end to end.
- F. Install cables without damaging conductors, shield, or jacket.
- G. Boxes and enclosures containing security system components or cabling, and which are easily accessible to employees or to the public, shall be provided with a lock. Boxes above ceiling level in occupied areas of the building shall not be considered to be accessible. Junction boxes and small device enclosures below ceiling level and easily accessible to employees or the public shall be covered with a suitable cover plate and secured with tamperproof screws.
- H. Install end-of-line resistors at the field device location and not at the Controller or panel location.

**3.6 CABLE APPLICATION**

- A. Comply with EIA/TIA-569, "Commercial Building Standard for Telecommunications Pathways and Spaces."
- B. Cable application requirements are minimum requirements and shall be exceeded if recommended or required by manufacturer of system hardware.
- C. RS-232 Cabling: Install at a maximum distance of 50 feet (15 m).
- D. RS-485 Cabling: Install at a maximum distance of 4000 feet (1220 m).
- E. Card Readers and Keypads:
  - 1. Install number of conductor pairs recommended by manufacturer for the functions specified.
  - 2. Unless manufacturer recommends larger conductors, install No. 22 AWG wire if maximum distance from Controller to the reader is 250 feet

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- (75 m), and install No. 20 AWG wire if maximum distance is 500 feet (150 m).
3. For greater distances, install "extender" or "repeater" modules recommended by manufacturer of the Controller.
  4. Install minimum No. 18 AWG shielded cable to readers and keypads that draw 50 mA or more.
- F. Install minimum No. 16 AWG cable from Controller to electrically powered locks. Do not exceed [250 feet (75 m)] [500 feet (150 m)] <Insert distance>.
- G. Install minimum No. 18 AWG ac power wire from transformer to Controller, with a maximum distance of [25 feet (8 m)] <Insert distance>.

**3.7 GROUNDING**

- A. Comply with Division 26 Section "Grounding and Bonding for Electrical Systems."
- B. Comply with IEEE 1100, "Power and Grounding Sensitive Electronic Equipment."
- C. Ground cable shields, drain conductors, and equipment to eliminate shock hazard and to minimize ground loops, common-mode returns, noise pickup, cross talk, and other impairments.
- D. Signal Ground:
  1. Terminal: Locate in each equipment room and wiring closet; isolate from power system and equipment grounding.
  2. Bus: Mount on wall of main equipment room with standoff insulators.
  3. Backbone Cable: Extend from signal ground bus to signal ground terminal in each equipment room and wiring closet.

**3.8 INSTALLATION**

- A. System installation shall be in accordance with UL 294, manufacturer and related documents and references, for each type of security subsystem designed, engineered and installed.
- B. Components shall be configured with appropriate "service points" to pinpoint system trouble in less than 30 minutes.
- C. The Contractor shall install all system components including Government furnished equipment, and appurtenances in accordance with the manufacturer's instructions, documentation listed in Sections 1.4 and 1.5 of this document, and shall furnish all necessary connectors,

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terminators, interconnections, services, and adjustments required for a operable system.

- D. The PACS will be designed, engineered, installed, and tested to ensure all components are fully compatible as a system and can be integrated with all associated security subsystems, whether the system is a stand alone or a network.
- E. For integration purposes, the PACS shall be integrated where appropriate with the following associated security subsystems:
  - 1. CCTV:
    - a. Provide 24 hour coverage of all entry points to the perimeter and agency buildings. As well as all emergency exits utilizing a fixed color camera.
    - b. Be able to monitor, control and record cameras on a 24 hours basis.
    - c. Be programmed automatically call up a camera when an access point is but into an alarm state.
    - d. For additional PACS system requirements as they relate to the CCTV, refer to Section 28 23 00, VIDEO SURVEILLANCE.
  - 2. EPPS:
    - a. Be programmed to go into an alarm state when an emergency call box or duress alarm/panic device is activated, and notify the Physical Access Control System and Database Management of an alarm event.
    - b. For additional PACS requirements as they relate to the EPPS, refer to Section 28 26 00, ELECTRONIC PERSONAL PROTECTION SYSTEM.
- F. Integration with these security subsystems shall be achieved by computer programming or the direct hardwiring of the systems.
- G. For programming purposes refer to the manufacturers requirements for correct system operations. Ensure computers being utilized for system integration meet or exceed the minimum system requirements outlined on the systems software packages.
- H. The Contractor shall visit the site and verify that site conditions are in agreement with the design package. The Contractor shall report all changes to the site or conditions that will affect performance of the system. The Contractor shall not take any corrective action without written permission from the Government.

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- I. The Contractor shall visit the site and verify that site conditions are in agreement/compliance with the design package. The Contractor shall report all changes to the site or conditions that will affect performance of the system to the Contracting Officer in the form of a report. The Contractor shall not take any corrective action without written permission received from the Contracting Officer.
- J. Existing Equipment:
1. The Contractor shall connect to and utilize existing door equipment, control signal transmission lines, and devices as outlined in the design package. Door equipment and signal lines that are usable in their original configuration without modification may be reused with Contracting Officer approval.
  2. The Contractor shall perform a field survey, including testing and inspection of all existing door equipment and signal lines intended to be incorporated into the PACS, and furnish a report to the Contracting Officer as part of the site survey report. For those items considered nonfunctioning, provide (with the report) specification sheets, or written functional requirements to support the findings and the estimated cost to correct the deficiency. As part of the report, the Contractor shall include a schedule for connection to all existing equipment.
  3. The Contractor shall make written requests and obtain approval prior to disconnecting any signal lines and equipment, and creating equipment downtime. Such work shall proceed only after receiving Contracting Officer approval of these requests. If any device fails after the Contractor has commenced work on that device, signal or control line, the Contractor shall diagnose the failure and perform any necessary corrections to the equipment.
  4. The Contractor shall be held responsible for repair costs due to Contractor negligence, abuse, or improper installation of equipment.
  5. The Contracting Officer shall be provided a full list of all equipment that is to be removed or replaced by the Contractor, to include description and serial/manufacturer numbers where possible. The Contractor shall dispose of all equipment that has been removed or replaced based upon approval of the Contracting Officer after reviewing the equipment removal list. In all areas where equipment

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is removed or replaced the Contractor shall repair those areas to match the current existing conditions.

- K. Enclosure Penetrations: All enclosure penetrations shall be from the bottom of the enclosure unless the system design requires penetrations from other directions. Penetrations of interior enclosures involving transitions of conduit from interior to exterior, and all penetrations on exterior enclosures shall be sealed with rubber silicone sealant to preclude the entry of water and will comply with VA Master Specification 07 84 00, Firestopping. The conduit riser shall terminate in a hot-dipped galvanized metal cable terminator. The terminator shall be filled with an approved sealant as recommended by the cable manufacturer and in such a manner that the cable is not damaged.
- L. Cold Galvanizing: All field welds and brazing on factory galvanized boxes, enclosures, and conduits shall be coated with a cold galvanized paint containing at least 95 percent zinc by weight.
- M. Control Panels:
1. Connect power and signal lines to the controller.
  2. Program the panel as outlined by the design and per the manufacturer's programming guidelines.
- N. SMS:
1. Coordinate with the VA agency's IT personnel to place the computer on the local LAN or Intranet and provide the security system protection levels required to insure only authorized VA personnel have access to the system.
  2. Program and set-up the SMS to ensure it is in fully operation.
- O. Card Readers:
1. Connect all signal inputs and outputs as shown and specified.
  2. Terminate input signals as required.
  3. Program and address the reader as per the design package.
  4. Readers shall be surface or flushed mounted and all appropriate hardware shall be provided to ensure the unit is installed in an enclosed conduit system.
- P. Entry Control Devices:
1. Install all signal input and power cables.
  2. Strikes and bolts shall be mounted within the door frame.

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3. Mortise locks shall be mounted within the door and an electric transfer hinge shall be utilized to transfer the wire from within the door frame to the mortise lock inside the door.
4. Electromagnetic locks shall be installed with the mag-lock mounted to the door frame and the metal plate mounted to the door.

**Q. System Start-Up:**

1. The Contractor shall not apply power to the PACS until the following items have been completed:
  - a. PACS equipment items and have been set up in accordance with manufacturer's instructions.
  - b. A visual inspection of the PACS has been conducted to ensure that defective equipment items have not been installed and that there are no loose connections.
  - c. System wiring has been tested and verified as correctly connected as indicated.
  - d. All system grounding and transient protection systems have been verified as installed and connected as indicated.
  - e. Power supplies to be connected to the PACS have been verified as the correct voltage, phasing, and frequency as indicated.
2. Satisfaction of the above requirements shall not relieve the Contractor of responsibility for incorrect installation, defective equipment items, or collateral damage as a result of Contractor work efforts.
3. The Commissioning Agent will observe startup and contractor testing of selected equipment. Coordinate the startup and contractor testing schedules with the Resident Engineer and Commissioning Agent. Provide a minimum of 7 days prior notice.

**R. Supplemental Contractor Quality Control:**

1. The Contractor shall provide the services of technical representatives who are familiar with all components and installation procedures of the installed PACS; and are approved by the Contracting Officer.
2. The Contractor will be present on the job site during the preparatory and initial phases of quality control to provide technical assistance.
3. The Contractor shall also be available on an as needed basis to provide assistance with follow-up phases of quality control.

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4. The Contractor shall participate in the testing and validation of the system and shall provide certification that the system installed is fully operational as all construction document requirements have been fulfilled.

**3.9 SYSTEM SOFTWARE**

- A. Install, configure, and test software and databases for the complete and proper operation of systems involved. Assign software license to VAMC.

**3.10 FIELD QUALITY CONTROL**

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect[, test, and adjust] field-assembled components and equipment installation, including connections[, and to assist in field testing]. Report results in writing.
- B. Testing Agency: [Owner will engage] [Engage] a qualified testing and inspecting agency to perform field tests and inspections and prepare test reports:
- C. Perform the following field tests and inspections and prepare test reports:
  1. LAN Cable Procedures: Inspect for physical damage and test each conductor signal path for continuity and shorts. Use Class 2, bidirectional, Category 5 tester. Test for faulty connectors, splices, and terminations. Test according to TIA/EIA-568-1, "Commercial Building Telecommunications Cabling Standards - Part 1 General Requirements." Link performance for UTP cables must comply with minimum criteria in TIA/EIA-568-B.
  2. Test each circuit and component of each system. Tests shall include, but are not limited to, measurements of power supply output under maximum load, signal loop resistance, and leakage to ground where applicable. System components with battery backup shall be operated on battery power for a period of not less than 10 percent of the calculated battery operating time. Provide special equipment and software if testing requires special or dedicated equipment.
  3. Operational Test: After installation of cables and connectors, demonstrate product capability and compliance with requirements. Test each signal path for end-to-end performance from each end of all pairs installed. Remove temporary connections when tests have been satisfactorily completed.



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**3.11 PROTECTION**

- A. Maintain strict security during the installation of equipment and software. Rooms housing the control station, and workstations that have been powered up shall be locked and secured, with an activated burglar alarm and access-control system reporting to a Central Station complying with UL 1610, "Central-Station Burglar-Alarm Units," during periods when a qualified operator in the employ of Contractor is not present.

**3.12 COMMISSIONING**

- A. Provide commissioning documentation in accordance with the requirements of Section 28 08 00 - COMMISSIONING OF ELECTRONIC SAFETY AND SECURITY SYSTEMS for all inspection, start up, and contractor testing required above and required by the System Readiness Checklist provided by the Commissioning Agent.
- B. Components provided under this section of the specification will be tested as part of a larger system. Refer to Section 28 08 00 - COMMISSIONING OF ELECTRONIC SAFETY AND SECURITY SYSTEMS and related sections for contractor responsibilities for system commissioning.

**3.13 DEMONSTRATION AND TRAINING**

- A. Provide services of manufacturer's technical representative for four hours to instruct VA personnel in operation and maintenance of units.
- B. Submit training plans and instructor qualifications in accordance with the requirements of Section 28 08 00 - COMMISSIONING OF ELECTRONIC SAFETY AND SECURITY SYSTEMS.
- C. Develop separate training modules for the following:
  - 1. Computer system administration personnel to manage and repair the LAN and databases and to update and maintain software.
  - 2. Operators who prepare and input credentials to man the control station and workstations and to enroll personnel.
  - 3. Security personnel.
  - 4. Hardware maintenance personnel.
  - 5. Corporate management.
- D. All testing and training shall be compliant with the VA General Requirements, Section 01 00 00, GENERAL REQUIREMENTS.

- - - E N D - - -

SECTION 28 23 00  
VIDEO SURVEILLANCE

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

- A. Provide and install a complete Video Surveillance System, which is identified as the Video Assessment and Surveillance System hereinafter referred to as the VASS System as specified in this section.
- B. This Section includes video surveillance system consisting of cameras, data transmission wiring, and a control station with its associated equipment.
- C. Video surveillance system Video assessment & surveillance system shall be integrated with monitoring and control system specified in Division 28 Section PHYSICAL ACCESS CONTROL/ELECTRONIC PERSONAL PROTECTION SYSTEM that specifies systems integration.

**1.2 RELATED WORK**

- A. Section 01 00 00 - GENERAL REQUIREMENTS. For General Requirements.
- B. Section 07 84 00 - FIRESTOPPING. Requirements for firestopping application and use.
- C. Section 10 14 00 - SIGNAGE. Requirements for labeling and signs.
- D. Section 26 05 11 - REQUIREMENTS FOR ELECTRICAL INSTALLATIONS. Requirements for connection of high voltage.
- E. Section 26 05 21 - LOW VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES (600 VOLTS AND BELOW). Requirements for power cables.
- F. Section 28 05 00 - COMMON WORK RESULTS FOR ELECTRONIC SAFETY AND SECURITY. Requirements for general requirements that are common to more than one section in Division 28.
- G. Section 28 05 13 - CONDUCTORS AND CABLES FOR ELECTRONIC SAFETY AND SECURITY. Requirements for conductors and cables.
- H. Section 28 05 26 - GROUNDING AND BONDING FOR ELECTRONIC SAFETY AND SECURITY. Requirements for grounding of equipment.
- I. Section 28 05 28.33 - CONDUITS AND BACKBOXES FOR ELECTRONIC SAFETY AND SECURITY. Requirements for infrastructure.
- J. Section 28 13 00 - PHYSICAL ACCESS CONTROL SYSTEM. Requirements for physical access control system integration.
- K. Section 28 26 00 - ELECTRONIC PERSONAL PROTECTION SYSTEM (EPPS). Requirements for emergency and interior communications.

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**1.3 DEFINITIONS**

- A. AGC: Automatic gain control.
- B. B/W: Black and white.
- C. CCD: Charge-coupled device.
- D. CIF: Common Intermediate Format CIF images are 352 pixels wide and 88/240 (PAL/NTSC) pixels tall (352 x 288/240).
- E. 4CIF: resolution is 704 pixels wide and 576/480 (PAL/NTSC) pixels tall (704 x 576/480).
- F. H.264 (also known as MPEG4 Part 10): a encoding format that compresses video much more effectively than older (MPEG4) standards.
- G. ips: Images per second.
- H. MPEG: Moving picture experts group.
- I. MPEG4: a video encoding and compression standard that uses inter-frame encoding to significantly reduce the size of the video stream being transmitted.
- J. NTSC: National Television System Committee.
- K. UPS: Uninterruptible power supply.
- L. PTZ: refers to a movable camera that has the ability to pan left and right, tilt up and down, and zoom or magnify a scene.

**1.4 QUALITY ASSURANCE**

- A. The Contractor shall be responsible for providing, installing, and the operation of the VASS System as shown. The Contractor shall also provide certification as required.
- B. The security system shall be installed and tested to ensure all components are fully compatible as a system and can be integrated with all associated security subsystems, whether the security system is stand-alone or a part of a complete Information Technology (IT) computer network.
- C. The Contractor or security sub-contractor shall be a licensed security Contractor as required within the state or jurisdiction of where the installation work is being conducted.
- D. Manufacturers Qualifications: The manufacturer shall regularly and presently produce, as one of the manufacturer's principal products, the equipment and material specified for this project, and shall have manufactured the item for at least three years.

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**E. Product Qualification:**

1. Manufacturer's product shall have been in satisfactory operation, on three installations of similar size and type as this project, for approximately three years.
2. The Government reserves the right to require the Contractor to submit a list of installations where the products have been in operation before approval.

**F. Contractor Qualification:**

1. The Contractor or security sub-contractor shall be a licensed security Contractor with a minimum of five (5) years' experience installing and servicing systems of similar scope and complexity. The Contractor shall be an authorized regional representative of the Video Assessment and Surveillance System's (VASS) manufacturer. The Contractor shall provide four (4) current references from clients with systems of similar scope and complexity which became operational in the past three (3) years. At least three (3) of the references shall be utilizing the same system components, in a similar configuration as the proposed system. The references must include a current point of contact, company or agency name, address, telephone number, complete system description, date of completion, and approximate cost of the project. The Resident Engineer reserves the option to visit the reference sites, with the site Resident Engineer's permission and representative, to verify the quality of installation and the references' level of satisfaction with the system. The Contractor shall provide copies of system manufacturer certification for all technicians. The Contractor shall only utilize factory-trained technicians to install, program, and service the VASS. The Contractor shall only utilize factory-trained technicians to install, terminate and service cameras, control, and recording equipment. The technicians shall have a minimum of five (5) continuous years of technical experience in electronic security systems. The Contractor shall have a local service facility. The facility shall be located within 60 miles of the project site. The local facility shall include sufficient spare parts inventory to support the service requirements associated with this contract. The facility shall also include appropriate diagnostic equipment to perform diagnostic procedures. The COTR reserves the option of

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- surveying the company's facility to verify the service inventory and presence of a local service organization.
2. The Contractor shall provide proof project superintendent with BICSI Certified Commercial Installer Level 1, Level 2, or Technician to provide oversight of the project.
  3. Cable installer must have on staff a Registered Communication Distribution Designer (RCDD) certified by Building Industry Consulting Service International. The staff member shall provide consistent oversight of the project cabling throughout design, layout, installation, termination and testing.
- G. Service Qualifications: There shall be a permanent service organization maintained or trained by the manufacturer which will render satisfactory service to this installation within four hours of receipt of notification that service is needed. Submit name and address of service organizations.

**1.5 SUBMITTALS**

- A. Submit below items in conjunction with Master Specification Sections 01 33 23, Shop Drawings, Product Data, and Samples, and Section 02 41 00, Demolition Drawings.
- B. Provide certificates of compliance with Section 1.4, Quality Assurance.
- C. Provide a pre-installation and as-built design package in both electronic format and on paper, minimum size 1220 x 1220 millimeters (48 x 48 inches); drawing submittals shall be per the established project schedule.
- D. Pre-installation design and as-built packages shall include, but not be limited to:
  1. Index Sheet that shall:
    - a. Define each page of the design package to include facility name, building name, floor, and sheet number.
    - b. Provide a list of all security abbreviations and symbols.
    - c. Reference all general notes that are utilized within the design package.
    - d. Specification and scope of work pages for all security systems that are applicable to the design package that will:
      - 1) Outline all general and job specific work required within the design package.

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- 2) Provide a device identification table outlining device Identification (ID) and use for all security systems equipment utilized in the design package.
2. Floor plans, site plans, and enlarged plans shall:
  - a. Include a title block as defined above.
  - b. Define the drawings scale in both standard and metric measurements.
  - c. Provide device identification and location.
  - d. Address all signal and power conduit runs and sizes that are associated with the design of the electronic security system and other security elements (e.g., barriers, etc.).
  - e. Identify all pull box and conduit locations, sizes, and fill capacities.
  - f. Address all general and drawing specific notes for a particular drawing sheet.
3. A riser drawing for each applicable security subsystem shall:
  - a. Indicate the sequence of operation.
  - b. Relationship of integrated components on one diagram.
  - c. Include the number, size, identification, and maximum lengths of interconnecting wires.
  - d. Wire/cable types shall be defined by a wire and cable schedule. The schedule shall utilize a lettering system that will correspond to the wire/cable it represents (example: A = 18 AWG/1 Pair Twisted, Unshielded). This schedule shall also provide the manufacturer's name and part number for the wire/cable being installed.
4. A system drawing for each applicable security system shall:
  - a. Identify how all equipment within the system, from main panel to device, shall be laid out and connected.
  - b. Provide full detail of all system components wiring from point-to-point.
  - c. Identify wire types utilized for connection, interconnection with associate security subsystems.
  - d. Show device locations that correspond to the floor plans.
  - e. All general and drawing specific notes shall be included with the system drawings.

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5. A schedule for all of the applicable security subsystems shall be included. All schedules shall provide the following information:
    - a. Device ID.
    - b. Device Location (e.g. site, building, floor, room number, location, and description).
    - c. Mounting type (e.g. flush, wall, surface, etc.).
    - d. Power supply or circuit breaker and power panel number.
    - e. In addition, for the VASS Systems, provide the camera ID, camera type (e.g. fixed or pan/tilt/zoom (P/T/Z), lens type (e.g. for fixed cameras only) and housing model number.
  6. Detail and elevation drawings for all devices that define how they were installed and mounted.
- E. Pre-installation design packages shall be reviewed by the Contractor along with a VA representative to ensure all work has been clearly defined and completed. All reviews shall be conducted in accordance with the project schedule. There shall be four (4) stages to the review process:
1. 35 percent
  2. 65 percent
  3. 90 percent
  4. 100 percent
- F. Provide manufacturer security system product cut-sheets. Submit for approval at least 30 days prior to commencement of formal testing, a Security System Operational Test Plan. Include procedures for operational testing of each component and security subsystem, to include performance of an integrated system test.
- G. Submit manufacture's certification of Underwriters Laboratories, Inc. (UL) listing as specified. Provide all maintenance and operating manuals per the VA General Requirements, Section 01 00 00, GENERAL REQUIREMENTS.
- H. Submit completed System Readiness Checklists provided by the Commissioning Agent and completed by the contractor, signed by a qualified technician and dated on the date of completion, in accordance with the requirements of Section 28 08 00 COMMISSIONING OF ELECTRONIC SAFETY AND SECURITY SYSTEMS.

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**1.6 APPLICABLE PUBLICATIONS**

- A. The publications listed below (including amendments, addenda, revisions, supplement, and errata) form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.
- B. American National Standards Institute (ANSI)/Electronic Industries Alliance (EIA):
- 330-09 .....Electrical Performance Standards for CCTV  
Cameras
- 375A-76 .....Electrical Performance Standards for CCTV  
Monitors
- C. Institute of Electrical and Electronics Engineers (IEEE):
- C62.41-02 .....IEEE Recommended Practice on Surge Voltages in  
Low-Voltage AC Power Circuits
- 802.3af-08 .....Power over Ethernet Standard
- D. Federal Communications Commission (FCC):
- (47 CFR 15) Part 15 ....Limitations on the Use of Wireless  
Equipment/Systems
- E. National Electrical Contractors Association (NECA):
- 303-2005 .....Installing Closed Circuit Television (CCTV)  
Systems
- F. National Fire Protection Association (NFPA):
- 70-08 .....Article 780-National Electrical Code
- G. Federal Information Processing Standard (FIPS):
- 140-2-02 .....Security Requirements for Cryptographic Modules
- H. Underwriters Laboratories, Inc. (UL):
- 983-06 .....Standard for Surveillance Camera Units
- 3044-01 .....Standard for Surveillance Closed Circuit  
Television Equipment

**1.7 COORDINATION**

- A. Coordinate arrangement, mounting, and support of video surveillance equipment:
1. To allow maximum possible headroom unless specific mounting heights that reduce headroom are indicated.
  2. To provide for ease of disconnecting the equipment with minimum interference to other installations.



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- 3. To allow right of way for piping and conduit installed at required slope.
- 4. So connecting raceways, cables, wireways, cable trays, and busways will be clear of obstructions and of the working and access space of other equipment.
- B. Coordinate installation of required supporting devices and set sleeves in cast-in-place concrete, masonry walls, and other structural components as they are constructed.
- C. Coordinate location of access panels and doors for video surveillance items that are behind finished surfaces or otherwise concealed.

**1.8 WARRANTY OF CONSTRUCTION**

- A. Warrant VASS System work subject to the Article "Warranty of Construction" of FAR clause 52.246-21.
- B. Demonstration and training shall be performed prior to system acceptance.

**PART 2 - PRODUCTS**

**2.1 GENERAL**

- A. Surge Protection: Protect components from voltage surges originating external to equipment housing and entering through power, communication, signal, control, or sensing leads. Include surge protection for external wiring of each conductor entry connection to components.
- B. Power Connections: Comply with requirements in Section 28 05 00 COMMON WORK REQUIREMENTS FOR ELECTRONIC SAFETY AND SECURITY, Part 2, as recommended by manufacturer for type of line being protected.
- C. Tamper Protection: Tamper switches on enclosures, control units, pull boxes, junction boxes, cabinets, and other system components shall initiate a tamper-alarm signal when unit is opened or partially disassembled. Control-station, control-unit alarm display shall identify tamper alarms and indicate locations.

**2.2 CAMERAS**

- A. All Cameras will be EIA 330 and UL 1. Minimum Protection for Power Connections 120 V and more: Auxiliary panel suppressors shall comply with requirements in Section 28 05 00 COMMON WORK REQUIREMENTS FOR ELECTRONIC SAFETY AND SECURITY, Part 2.

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B. Minimum Protection for Communication, Signal, Control, and Low-Voltage  
983 compliant as well as:

1. Will be charge coupled device (CCD cameras and shall conform to National Television System Committee (NTSC) formatting.
2. Fixed cameras shall be color and the primary choice for monitoring following the activities described below. Pan/Tilt/Zoom (P/T/Z) cameras shall be color and are to be utilized to complement the fixed cameras.
3. Shall be powered over Ethernet. Network switches supporting PoE cameras shall have a back-up power source to ensure cameras are still operational in the event of loss of primary power to the VASS System.
4. Shall be rated for continuous operation under the environmental conditions listed in Part 1, Project Conditions.
5. Each function and activity shall be addressed within the system by a unique user defined name, with minimum of twenty (20) characters. The use of codes or mnemonics identifying the VASS action shall not be accepted.
6. Shall come with built-in video motion detection that shall automatically monitor and process information from each camera. The camera motion detection shall detect motion within the camera's field of view and provide automatic visual, remote alarms as a result of detected motion.
7. Will be fitted with AI/DC lenses to ensure the image quality under different light conditions.
8. P/T/Z cameras shall be utilized in a manner that they complement fixed cameras and shall not be used as a primary means of monitoring activity.
9. Dummy or fake cameras will not be utilized at any time.
10. Appropriate signage shall be designed, provided, and posted that notifies people that an area is under camera surveillance.

## **2.3 DIGITAL BASED VIDEO MANAGEMENT SYSTEM**

### **A. Key Features:**

1. Open Platform: Open API/SDK, supports seamless integration with third party applications.
2. Multi-server and multi-site video surveillance solution: Unlimited recording of video from IP cameras, IP video encoders and selected DVRs with analog cameras.
3. Optimized Recording Storage Management: Unique data storage and archiving solution that combines superior performance and scalability and cost efficient long-term video storage
4. Wide IP camera and device support: Supports connection of more than 839 IP cameras, IP video encoders and selected DVR models from over 79 different vendors through dedicated device integration
5. ONVIF™ and PSIA compliant: Supports ONVIF™ and PSIA compliant cameras and devices
6. Wide compression technology support: Supports the news compression methods; MPEG4 ASP, MxPEG and H.264, besides MJPEG and MPEG4
7. System configuration wizards: Guides the user through the process of adding cameras, configuring video and recording, adjustment of motion detection and user configuration
8. Sequence Explorer: Displaying sequences and time intervals in thumbnail pre-views, the Sequence Explorer gives unparalleled visual overview of recorded video combined with smooth navigation
9. Overlay buttons: Intuitive control of cameras, camera-integrated devices and other integrated systems- directly from the camera view
10. Independent Playback: Instant and independent playback function allows you to independently playback recorded video for one or more cameras, while in live viewing or playback mode
11. Built-in Video Motion Detection: Independent of camera model and supporting up to 64 cameras simultaneously per server
12. Multiple language support: Let operators use the system in their native language with support for 20 different languages
13. Multi-channel, two-way audio: Communicate with people at gates/entrances or broadcast messages to many people at once with multichannel, two-way audio

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14. Fast evidence export: Quickly deliver authentic evidence to public authorities by exporting video to various formats, including video from multiple cameras with viewer, logs, and user notes included

**B. Administration Features**

1. Single Management Application: A new Management Application provides a consolidated single point management access to Recording Servers.
2. System configuration wizards: Guides the user through the process of adding cameras, configuring video and recording, adjustment of motion detection and user configuration.
3. Automated device discovery: Enables fast discovery of camera devices using methods such as Universal Plug And Play, Broadcast and IP Range scanning.
4. Smart bulk configuration option: Change settings across multiple devices simultaneously and in a very few clicks.
5. Adaptable application behavior: Guides novice users, while expert users can optimize the application for efficient use.
6. Export/import of system and user configuration data: System backup for reliable system operation and fast system recovery. System cloning for efficient rollout of multiple systems with the same, or similar, configuration.
7. Import of off-line configuration data: Enabling off-line editing of configuration data, including camera and device definitions.
8. Automatic system restore points: A 'Restore Point' is created each time a configuration change is confirmed.
9. Enables easy rollback to previously defined system configuration points and enables cancelation of undesired configuration changes and restoration of earlier valid configurations.

**C. Integration Options:**

1. Open Software Development Kit (SDK) makes it possible to video enable your business processes, through seamless integration of third party applications, such as video analytics, access systems, etc.
2. Compatible with Central for alarm overviews and operational status in larger video surveillance installations.
3. Integrate with physical access control systems, alarms, gates, building management systems, etc. using hardware I/O, internal events and TCP/IP events

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4. Create, import and use HTML pages for navigation between views or to trigger a Smart Wall preset
5. Develop third party plug-ins for the Smart Client to expand with new functionality

D. Server Modules:

1. Recording Server:
  - a. Simultaneous digital multi-channel video and audio recording and live viewing (relaying).
  - b. Two-way audio enables integrated control of microphones and speakers connected to IP devices.
  - c. Bandwidth optimized multi-streaming by splitting a single camera video stream to differentiated streams for live view and recording, where each can be optimized independently with respect to frame rate and resolution.
  - d. Connectivity to cameras, video encoders and selected DVRs supports MJPEG, MPEG4, MPEG4 ASP\*, H.264\* and MxPEG.
  - e. Auto-detect camera models during setup.
2. Flexible multi-site, multi-server license structure charged per camera.
3. Unlimited number of installed cameras; simultaneous recording and live view of up to 64 cameras per server.
4. Recording technology: secure high speed database holding JPEG images or MPEG4 and MxPEG streams including audio.
5. Recording speed: 30+ frames per second per camera, limited only by hardware.
6. Recording quality depends entirely on camera and video encoder capabilities: no software limitation.
7. Start cameras on live view requests from clients.
8. Unlimited recording capacity with multiple archives possible per day.
9. Hourly to daily database archiving with optional automatic move to network drive saves storage capacity on the local server - with images still available transparently for playback
10. Built-in, real-time, camera independent motion detection (VMD); fully adjustable sensitivity, zone exclusions, recording activation with frame rate speed up, and alert activation through email or SMS.
11. Start recording on event.

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12. Client initiated start of recording based on pre-defined recording time and access privileges.
  13. Pan Tilt Zoom (PTZ) preset positions, up to 50 per camera.
  14. Absolute\* and relative PTZ positioning.
  15. PTZ go-to preset position on events.
  16. Combine PTZ patrolling and go-to positions on events.
  17. Set multiple patrolling schedules per camera per day: i.e. different for day/night/weekend.
  18. PTZ scanning on supported devices: viewing or recording while moving slowly between PTZ positions.
  19. VMD-sensitive PTZ patrolling among selected presets allows sending of Wipe and Wash commands to supported PTZ models.
  20. On pre-defined events Matrix remote commands are automatically sent to display live video remotely on computers running the Matrix Monitor or the Smart
  21. Client with Matrix Plug-in.
    - a. Flexible notification (sound, e-mail and SMS) and camera patrolling scheduling, triggered by time or event.
- E. Recording Server Manager:
1. Local console management of the Recording Server accessible from the notification area.
  2. Start and stop Recording Server service.
  3. Access to Recording Server configuration settings.
  4. Access to Recording Server help system.
  5. View system status and log information.
- F. Image Server:
1. Remote access for Smart and Remote Clients.
  2. Built-in web server for download and launch of clients and plug-ins.
  3. Set up one Master and multiple Slave Servers.
  4. Authenticate access based on Microsoft Active Directory user account, or user name and password.
  5. Authorize access privileges per Microsoft Active Directory user account/group, user profile or grant full access.
  6. User profiles control access to: Live view, PTZ, PTZ presets, Output control, Events, Listen to microphone, Talk to speaker, Manual recording; Playback, AVI export, JPG export, DB export, Sequences,

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Smart Search and audio. As well as Set up views, Edit private views and Edit shared public views.

7. Audit logs of exported evidence by user and file.
8. Audit logs of client user activity by time, locations and cameras.

G. Recording Viewer:

1. Playback recorded video and audio locally on the

H. Recording Server:

1. View up to 16 cameras time-synched during playback.
2. Scrollable activity timeline with magnifying feature.
3. Instant search on recordings based on date/time and activity/alarm (Video Motion Detection).
4. 'Smart Search' for highlighted image zones and objects.
5. Evidence can be generated as a printed report, a JPEG image, an AVI film or in the native database format.
6. Export audio recordings in WAV or AVI format.
7. Export video digitally zoomed to view area of interest only and to minimize export footprint size.
8. Export 'Evidence CD' containing native database and Recording Viewer for instant, easy viewing by authorities.
9. Encryption & password protection option for exported recordings and files.
10. Ability to add comments to exported evidence, also encrypted.
11. Option to send email.
12. De-interlacing of video from analog cameras.
13. IPIX technology for PTZ in 360° recorded images.

I. PDA Server:

1. Remote access for PDA Client.
2. Handle login and session requests between PDA clients and Image Server.
3. Resize video surveillance images to fit the screen layout of PDA Client.

J. Smart Client Module:

1. Smart Client includes all the features of Remote Client plus more:
2. Installed per default on Recording Server for local viewing and playback of video and audio.
3. Start recording on cameras for a pre-defined time (default 5 minutes). Subject to privileges set by administrator.

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4. Independent Playback capability allows for instant playback of recorded video for one or more cameras, while in live and playback mode
5. Live view digital zoom allows zoomed-out recordings while the operator digitally can zoom in to see details.
6. 'Update On Motion Only' optimizes CPU usage by letting motion detection control whether the image should be decoded and displayed or not. The visual effect is a still image in the view until motion is detected.
7. Shared and private camera views offer 1x1 up to 10x10 layouts in addition to asymmetric views.
8. Views optimized for both 4:3 and 16:9 screen ratios.
9. Multiple computer monitor support with a main window and any number of either windowed or full screen views.
10. Hotspot function for working in details with a camera selected from a view containing multiple cameras.
11. Carousel function allows a specified view to rotate between pre-defined cameras with individual timing and order with multiple appearances. Carousel function can be controlled allowing the operator to pause carousel function and to switch to previous or next camera.
12. Overlay buttons provides intuitive control of cameras, camera-integrated devices and other integrated systems- directly from the camera view
13. Matrix function to view live video from multiple cameras through the Image Server in any view layout with customizable rotation path, remotely controlled by Smart
14. Clients or Recording Servers sending Matrix remote commands
15. Send Matrix remote commands to display live video remotely on computers running the Matrix Monitor or the Smart Client with Matrix Plug-in.
16. Cameras' built-in audio sources available in live and in playback.
17. Separate pop-up window displaying sequences and time intervals in thumbnail pre-views, the Sequence Explorer gives unparalleled visual overview of recorded video combined with smooth navigation
18. Presents recorded sequences for individual cameras, or all cameras in a view



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19. Seamlessly available in both Live and Playback modes
20. Smooth navigation with sliding preview and "drag-andthrow" function for video thumbnails
21. Instant playback of video sequences
22. Application Options allows users to adapt the layout and personalize the application to their particular preferences

**K. Remote Client:**

1. View live video or playback recordings for 1-16 cameras simultaneously; from the same or different servers.
2. Advanced video navigation including fast/slow playback, jump to date/time, single step and video motion search.
3. Individual views can be user-defined in various layouts: view or playback camera images from multiple servers simultaneously in the same view.
4. Shared views can be managed centrally via the server with admin/user rights and user groups.
5. Import static or active HTML maps for fast navigation to cameras and good premise overviews.
6. Control output port relay operation, for example control of gates.
7. Quick overview of sequences with detected motion and preview window.
8. Quick overview of events/alerts.
9. Control PTZ cameras remotely, also using preset positions.
10. Remote PTZ Point-and-Click control
11. Remote PTZ zoom to a marked rectangle.
12. Take manual control over a PTZ camera that runs a patrolling scheme; after a timeout with no activity the camera reverts to its scheduled patrolling.
13. IPIX 1x2 or 2x2 'Quad View' for viewing all 360° at once.
14. Optional video compression in streaming from server to client gives better use of bandwidth.
15. Create AVI files or save JPEG images.
16. Print incident reports with free-text user comments.
17. System logon using user name and password.
18. System logon using Microsoft Active Directory user accounts.

**L. PDA Client:**

1. View live or playback video from a single server or from multiple servers in half-screen or full-screen formats.

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2. In live view you can control Pan/Tilt/Zoom cameras manually or use preset positions, and control the cameras' output relays to trigger external actions like opening doors or gates, turning on lights, etc.
3. To find recordings, you can jump to specific time/date or to next detected motion, or use motion detection sequence overviews.
4. When viewing recordings, you can playback at variable speed or single step image by image.
5. The PDA client shall connect to the VMS server using any IP connection; typically wireless LAN, GPRS, etc.
6. Video compression from the server to PDA optimizes bandwidth usage.
7. System logon using user name and password.

**M. Matrix Monitor:**

1. Virtual Matrix showing live video directly from up to 4 cameras at a time triggered remotely by Matrix remote commands.
2. Camera view shifts by FIFO (first-in-first-out)
3. Multiple events can control a single Matrix monitor and single events can control multiple monitors.

**N. Minimum System Requirements VMS Server:**

1. HW Platform:
  - a. Minimum 2.4 GHz CPU and 1 GB RAM (2.4 GHz dual core processor and 2 GB RAM or more recommended).
  - b. Minimum 1 GB disk space available, excluding space needed for recordings.
2. OS:
  - a. Microsoft® Windows® XP Professional (32 bit or 64 bit\*), Windows Server 2003 (32 bit or 64 bit\*), Windows Server 2008 R1/R2 (32 bit or 64 bit\*), Windows Vista™ Business (32 bit or 64 bit\*), Windows Vista Enterprise (32 bit or 64 bit\*), Windows Vista Ultimate (32 bit or 64 bit\*), Windows 7 Professional (32 bit or 64 bit\*), Windows 7 Enterprise (32 bit or 64 bit\*) and Windows 7 Ultimate (32 bit or 64 bit\*).
3. Software:
  - a. Microsoft .NET 3.5 Framework SP1, or newer.
  - b. DirectX 9.0 or newer required to run Playback Viewer application.

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O. Minimum System Requirements PDA Server:

1. HW Platform:
  - a. Minimum 2.4 GHz CPU and 1 GB RAM (2.4 GHz dual core processor and 2 GB RAM or more recommended).
  - b. Minimum 1 GB disk space available.
2. OS:
  - a. Microsoft Windows XP Professional (32 bit or 64 bit\*), Windows Server 2003 (32 bit or 64 bit\*).
3. Software:
  - a. Microsoft .NET 2.0 (not compatible with newer versions). Internet Information Server (IIS) 5.1.

P. Minimum System Requirements VMS Client:

1. HW Platform:
  - a. Minimum 2.4 GHz CPU, 1 GB RAM (more powerful CPU and higher RAM recommended for Smart Clients running high number of cameras and multiple views and displays).
2. Graphics Card:
  - a. AGP or PCI-Express, minimum 1024 x 768 (1280 x 1024 recommended), 16 bit colors.
3. OS:
  - a. Microsoft Windows XP Professional (32 bit or 64 bit\*), Windows Server 2003 (32 bit or 64 bit\*), Windows Server 2008 R1/R2 (32 bit or 64 bit\*), Windows Vista Business (32 bit or 64 bit\*), Windows Vista Enterprise (32 bit or 64 bit\*), Windows Vista Ultimate (32 bit or 64 bit\*), Windows 7 Professional (32 bit or 64 bit\*), Windows 7 Enterprise (32 bit or 64 bit\*) and Windows 7 Ultimate (32 bit or 64 bit\*).
4. Software:
  - a. DirectX 9.0 or newer required to run Playback Viewer application.
  - b. Microsoft .NET 3.5 Framework SP1, or newer.

Q. Minimum System Requirements VMS Remote Client:

1. HW Platform:
  - a. Minimum 2.4 GHz CPU, RAM 1 GB (2 GB or higher recommended on Microsoft Windows Vista).
2. OS:
  - a. Microsoft Windows XP Professional (32 bit or 64 bit\*), Windows Server 2003 (32 bit or 64 bit\*), Windows Server 2008 R1/R2 (32

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bit or 64 bit\*), Windows Vista Business (32 bit or 64 bit\*), Windows Vista Enterprise (32 bit or 64 bit\*) and Windows Vista Ultimate (32 bit or 64 bit\*), Windows 7 Professional (32 bit or 64 bit\*), Windows 7 Enterprise (32 bit or 64 bit\*) and Windows 7 Ultimate (32 bit or 64 bit\*).

3. Software:

- a. DirectX 9.0 or newer required to run Playback Viewer Application
- Microsoft Internet Explorer 6.0, or newer, 32 bit version required

R. Licensing Structure:

1. Base Server License:

- a. An VMS Base Server license is mandatory for installing the product.

2. The Base Server license contains:

- a. Unlimited numbers of Recording Server licenses
- b. Unlimited numbers of Smart Clients, Remote Clients, PDA Clients and Matrix Monitor licenses

3. Camera License:

- a. To connect to a camera, a Device License per camera channel is required
- b. In total, for all copies of the product installed under a given Base Server license, the product may only be used with as many cameras as you have purchased camera licenses for • Video encoders and DVRs with multiple analog cameras require a license per channel to operate
- c. Camera Licenses can be purchased in any numbers. To extend the installation with additional Camera Licenses, the Base Server License number (SLC) is required when ordering.

4. Client License:

- a. All client modules are not licensed and can be installed and used on any number of computers.

S. IP Network Decoder:

- 1. The unit shall be used for video monitoring and surveillance over IP networks. Network decoder shall decode MPEG-4 digital video to analog video.
- 2. The decoder shall use MPEG-4 compression for efficient distribution of images over a network.

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3. The decoder shall be available as a standalone unit that can be horizontally or vertically mounted.
4. The decoder shall include, but not be limited to the following:
  - a. The decoder shall use "hybrid" technology in providing both analog and network connections with the purpose of allowing users to integrate existing equipment and digital IP products.
    - 1) The decoder shall provide one composite video input and output connection.
    - 2) The decoder shall provide one Ethernet connection.
  - b. The decoder shall have the following digital resolution:
    - 1) D1: 720x576 (NTSC); 720x480 (PAL)
    - 2) CIF: 352 x 288 (NTSC); 352 x 240 (PAL)
    - 3) QCIF: 160 x 144 (NTSC); 160 x 112 (PAL)
  - c. The decoder shall have a digital frame rate of up to 30 frames per second (NTSC) at 720x480 resolution or 25 fps (PAL) at 720x586 resolution.
  - d. The decoder shall use the following protocols:
    - 1) TCP/IP
    - 2) UDP/IP
    - 3) DHCP
    - 4) Multicast
    - 5) Data Throttle
    - 6) Heart beat
  - e. The decoder shall have the following connectors:
    - 1) Power connector: 3-pin male - for connecting the external power supply
    - 2) I/O connector: 16-pin male - for connecting alarm, audio, RS-232, RS-485 input and output
    - 3) Video I/O connector: SVHS style - for input and output connection of two composite monitors
    - 4) Ethernet port: RJ-45 - for connecting to a network
  - f. The decoder shall have the following indicators:
    - 1) Power LED
    - 2) Link - indicates activity on the Ethernet port
    - 3) Tx activity
    - 4) Rx activity

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5. The decoder shall have the following additional specifications:

a. Video:

- 1) Video signal output: 1 V p-p into 75 ohms
- 2) Input termination: 75 ohm
- 3) Video compression standard: MPEG-4
- 4) Audio compression standard: MPEG-1 Layer 2

b. Audio:

- 1) Audio input: 315 mV, 40 kOhms, unbalanced
- 2) Audio output: 315 mV, 600 ohms, unbalanced

c. Electrical:

- 1) External power supply: 100 to 240 VAC
- 2) Output voltage: 13.5 V, 1.33 A
- 3) Power consumption: 0.5 W maximum

T. Manufacturer: Panasonic WJ-ND400.

**2.4 VIDEO DISPLAY EQUIPMENT**

A. Video Display Equipment:

1. Will consist of color monitors and shall be EIA 375A compliant.
2. Shall be able to display analog, digital, and other images in either NTSC or MPEG format associated with the operation of the Security Management System (SMS).
3. Shall:
  - a. Have front panel controls that provide for power on/off, horizontal and vertical hold, brightness, and contrast.
  - b. Accept multiple inputs, either directly or indirectly.
  - c. Have the capabilities to observe and program the VASS System.
  - d. Be installed in a manner that they cannot be witnessed by the general public.

B. Color Video Monitors Technical Characteristics:

Sync Format	PAL/NTSC
Display Tube	90° deflection angle
Horizontal Resolution	250 TVL minimum, 300 TVL typical
Video Input	1.0 Vp-p, 75 Ohm
Front Panel Controls	Volume, Contrast, Brightness, Color
Connectors	BNC

C. Liquid Crystal Display (LCD) Flat Panel Display Monitor

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- D. The 70-inch color LCD monitor shall have a flat screen and 70-inch diagonal viewing area and consists of an LCD panel, bezel, and stand.
- E. The monitor shall meet or exceed the following specifications:
  - 1. The monitor shall incorporate a 70-inch active matrix TFT LCD panel.
    - a. The pixel pitch of the monitor's LCD panel shall be 0.264 mm horizontal and 0.264 mm vertical.
    - b. The monitor shall have a maximum resolution of 1920 x 1080 pixels.
    - c. The contrast ratio shall be 1200:1.
    - d. The typical brightness shall be 700 cd/m<sup>2</sup>
    - e. The monitor shall display at least 16.7 million colors.
    - f. The light source for the LCD panel shall have a lifetime of 50,000 hours.
    - g. The scan frequency horizontal shall be 30 K to 80 KHz and the scan frequency vertical shall be 56 to 75 Hz.
    - h. The viewing angle for the monitor shall be 178 degrees horizontal and 178 degrees vertical.
  - 2. The monitor shall have automatic NTSC or PAL recognition.
  - 3. The monitor shall use the following signal connectors:
    - a. Video 1.0 V peak-to-peak at 75 ohms
    - b. HDMI
    - c. DVI-D
    - d. Audio in/out
    - e. VGA 15-pin D-Sub
  - 4. The monitor shall have two audio speaker(s).
    - a. The speaker shall be 5 W minimum.
  - 5. The monitor shall have the following front control panel buttons:
    - a. Power on/off
    - b. LED indicator
    - c. Mode
    - d. Increase (volume)
    - e. Decrease (volume)
    - f. Up (contrast adjustment)
    - g. Down (brightness adjustment)
    - h. Menu
    - i. Auto

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6. The monitor shall have the following options for adjustment in an onscreen display menu:

- a. Color
- b. Tint
  - 1) NTSC mode only
    - a) Brightness
    - b) Contrast
    - c) Sharpness
    - d) Volume
    - e) Language
    - f) Scan
    - g) Color Temp
    - h) H-Position
    - i) Recall

F. The electrical specifications for the monitor shall be as follows:

- 1. Input voltage shall be 12 VDC/3 A.
- 2. Power consumption shall be 50 W maximum.

G. The environmental specifications for the monitor shall be as follows:

- 1. Operating temperature shall be 32 to 104 degrees Fahrenheit or 0 to 40 degrees Celsius.
- 2. Operating humidity shall be 10 to 85 percent.

H. The physical specifications for the monitor shall be as follows:

I. The monitor shall conform to these compliance standards:

- 1. FCC.
- 2. CE (EMC/LVD).
- 3. UL.

## **2.5 VIDEO CAMERAS**

A. The cameras shall be high-resolution color video cameras with wide dynamic range capturing capability.

B. Network Cameras:

- 1. Shall be IEEE 802.3af compliant.
  - a. Shall be utilized for interior and exterior purposes.



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- b. A Category CAT6 cable will be the primary source for carrying signals up to 100 m(300 ft. ) from a switch hub or network server. If any camera is installed greater than 100 m (300 ft. ) from the controlling device then the following will be required:
    - 1) A local or remote 12 VDC or 24 VAC power source will be required from a Class 2, UL compliant power supply.
    - 2) A signal converter will be required to convert from a CAT6 cable over to a fiber optic or standard signal cable. The signal will need to be converted back to a CAT6 cable at the controlling device using a signal converter card.
  - c. Shall be routed to a controlling device via a network switch.
  - d. Shall be a programmable IP address that allows for installation of multiple units in the same Local Area Network (LAN) environment.
  - e. Incorporate a minimum of Transmission Control Protocol (TCP)/IP, User Datagram Protocol (UDP), Hypertext Transfer Protocol (HTTP), File Transfer Protocol (FTP), Internet Control Message Protocol (ICMP), Address Resolution Protocol (ARP), Real-Time Transport Protocol (RTP), Dynamic Host Configuration Protocol (DHCP), Network Time Protocol (NTP), Simple Mail Transfer Protocol (SMTP), Internet Group Management Protocol (IGMP), and Differentiated Service Code Point (DSCP) protocols for various network applications.
- C. Fixed Network Camera:
- 1. The fixed network camera shall have following technical characteristics:

Video Standards	MPEG-4; M-JPEG
Video Data Rate	9.6 Kbps - 6 Mbps Constant & variable
Image Resolution	800x600 (SYGA)
Video Resolution	704 x 576/480 (4CIF: 25/30 IPS) 704 x 288/240 (2CIF: 25/30 IPS) 352 x 288/240 (CIF: 25/30 IPS) 176 x 144/120 (QCIF: 25/30 IPS)
Select Frame Rate	1-25/30 IPS (PAL/NTSC);Field/frame based coding
Network Protocols	RTP, Telnet, UDP, TCP, IP, HTTP,

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	IGMP, ICMP
Software Update	Flash ROM, remote programmable
Configuration	Via web browser, built-in web server interfaces
Sensitivity	1 0.65 lux (color) 0.26 lux (NightSense)
Minimum Illumination	0.20 lux (color)0.13 lux (NightSense)
Video Signal-to-Noise Ratio	50 dB
Video Signal Gain	21 dB, (max) Electronic Shutter Automatic, up to 1/150000 sec. (NTSC)
Alarm In	Automatic sensing (2500 - 9000 K)
Input Voltage	+5 V nominal, +40 VDC max VDC: 11-36 V (700 mA) VAC: 12-28 V (700 mA) PoE: IEEE 802.3af compliant

2. Camera accessories shall include:

- a. Recessed ceiling bracket

D. Camera Housings and Mounts:

1. This section pertains to all interior and exterior housings, domes, and applicable wall, ceiling, corner, pole, and rooftop mounts associated with the housing. Housings and mounts shall be specified in accordance to the type of cameras used.
2. All cameras and lenses shall be enclosed in a tamper resistant housing. Any additional mounting hardware required to install the camera housing at its specified location shall be provided along with the housing.
3. The camera and lens contained inside the housing shall be installed on a camera mount. All additional mounting hardware required to install the camera housing at its specified location shall be provided along with the housing.
4. Shall be manufactured in a manner that are capable of supporting a maximum of three (3) cameras with housings, and meet environmental requirements for the geographical area the camera support equipment is being installed on or within.

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5. Environmentally Sealed:

- a. Shall be designed in manner that it provides a condensation free environment for correct camera operation.
  - b. Shall be operated in a 100 percent condensing humidity atmosphere.
  - c. Shall be constructed in a manner that:
    - 1) Has a fill valve to allow for the introduction of nitrogen into the housing to eliminate existing atmospheric air and pressurize the housing to create moisture free conditions.
    - 2) Has an overpressure valve to prevent damage to the housing in the event of over pressurization.
    - 3) Is equipped with a humidity indicator that is visible to the eye to ensure correct atmospheric conditions at all times.
    - 4) The leak rate of the housing is not to be greater than 13.8kPa or 2 pounds per square inch at sea level within a 90 day period.
    - 5) It shall contain camera mounts or supports as needed to allow for correct positioning of the camera and lens.
    - 6) The housing and sunshield are to be white in color.
6. All electrical and signal cables required for correct operations shall be supplied in a hardened carrier system from the controller to the camera.
7. The mounting bracket shall be adjustable to allow for the housing weight of the camera and the housing unit it is placed in.
8. Accessibility to the camera and mounts shall be taken into consideration for maintenance and service purposes.

E. Indoor Mounts:

1. Ceiling Mounts:

- a. This enclosure and mount shall be installed in a finished or suspended ceiling.
- b. The enclosure and mount shall be fastened to the finished ceiling, and shall not depend on the ceiling tile grid for complete support.
- c. Suspended ceiling mounts shall be low profile, and shall be suitable for replacement of 610mm x 610mm (2 foot by 2 foot) ceiling tiles.

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**F. Interior Domes:**

1. The interior dome shall be ceiling mounted equipment.
2. The lower portion of the dome that provides camera viewing shall be made of black opaque acrylic and shall have a light attenuation factor of no more than 1 f-stop.
3. The housing shall be complete with wiring, wiring harness, connectors, receiver/driver, or any other hardware and equipment as needed to fully provide a fully functional dome.
4. Manufacturer: Panasonic WV-SF332

**2.6 POWER SUPPLIES**

- A. Power supplies shall be a low-voltage power supplies matched for voltage and current requirements of cameras and accessories, type as recommended by camera and lens manufacturer.
1. Rack mount.
  2. Enclosure: NEMA 250, Type 1

**2.7 NETWORK /MANAGEMENT SOFTWARE/SOFTWARE UPGRADE**

- A. Allow for the transmission of live video, data, and audio over either an existing Ethernet network or a dedicated security system network, requiring an IP address or Internet Explorer 5.5 or higher, or shall work as an analog-to-Ethernet "bridge" controlling matrices, multiplexers, and pan/tilt/zoom cameras. The network shall operate in a box-to-box configuration allowing for encoded video to be decoded and displayed on an analog monitor.
- B. If a VASS System network is going to be utilized as the primary means of monitoring, operating, and recording cameras then the following equipment shall be required as part of the system:
1. System Server
  2. Computer Workstation
  3. Recording Device
  4. Encoder/Decoder
  5. Monitor
  6. Hub/Switch
  7. Router
  8. Encryptor
- C. Shall provide overall control, programming, monitoring, and recording of all cameras and associated devices within the VASS System.
- D. All equipment on the network shall be IP addressable.

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- E. The VASS System network shall meet or exceed the following design and performance specifications:
1. Two MPEG-4 video streams for a total of 40 images per second will be provided.
  2. PC Software that manages the installation and maintenance of all hardware transmitters and receivers on the network shall be provided.
  3. Video Source that supports any NTSC video source to the computer network shall be addressed.
  4. Receivers that could be used to display the video on a standard analog NTSC or PAL monitor will be addressed.
- F. The system shall support the following network protocols:
1. Internet connections: RTP, Real Time Control Protocol (RTCP), UDP, IP, TCP, ICMP, HTTP, Simple Network Management Protocol (SNMP), IGMP, DHCP, and ARP.
  2. Video Display: MPEG-4, M-JPEG in server push mode only.
  3. Have the ability to adjust bandwidth, image quality and image rate.
  4. Support image sizes of either 704 x 576 pixels or 352 x 288 pixels.
  5. Have an audio coding format of G.711 or G.728.
  6. Provide a video frame rate of at least 30 images per second.
  7. Support LAN Interface Ethernet 10/100BaseT and be auto sensing.
  8. Have a LAN Data Rate of 9.6 Kbps to 5.0 Mbps.
  9. Utilize data interface RS-232/RS-422/RS-485.
- G. All connections within the system shall be via CAT-6 cable and RJ-45 jacks. If analog equipment is used as part of the system, then either an encoder or a decoder will be utilized to convert the analog signal to a digital one.
- H. The VASS network system shall conform to all VA agency wide security standards for administrator and operator use.
- I. Server Technical Characteristics:

Hardware	Personal Computer
CPU	Pentium IV, 3.0 GHz or better
Hard Disk Interface	IDE or better
RAM	256 MB
OS	Windows XP Home/XP Professional
Graphic Card	NVIDIA GeForce 6600 NVIDIA Quadro FX 1400

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	ATI RADEON X600/X800 or better
Ethernet Card	100 Mb
Software	DirectX 9.0c
Free Memory	120 MB

**J. Network Switch Technical Characteristics**

Protocol and standard	IEEE802.3 IEEE802.3u IEEE802.3ab
Ports	24 10/100/1000M auto-negotiation RJ-45 ports with auto MDI/MDI-X
Network media	Cat 5 UTP for 1,000Mbps Cat 3 UTP for 10Mbps
Transmission method	store-and-forward
LED	indicator power, act/link, speed

**K. Router Technical Characteristics**

Network Standards	IEEE 802.3, 802.3u 10Base-T Ethernet (WAN) 100Base-T Ethernet (LAN) IEEE 802.3x Flow Control IEEE802.1p Priority Queue ANS/IEEE 802.3 NWay auto-negotiation
Protocol	CSMA/CD, TCP, IP, UDP, PPPoE, AND DHCP (client and server)
VPN Supported	PPTP, IPSec pass-through
Management	Browser
Ports	4 x 10/100Base-T Auto sensing RJ45 ports, and an auto uplink RJ45port(s) 1 x 10Base-T RJ45 port, WAN
LEDs	Power, WAN Activity, LAN Link (10/100), LAN Activity

**L. Encryptor Technical Characteristics:**

Cryptography	Standard - Triple DES 168-bit (ANSI 9.52) Rijndael - AES (128, 192, 256)
Performance	Throughput (end-to-end) @ 100 Mbps line speed: >188 Mbps full duplex (large frames) >200 kfps full duplex (small frames) Latency (end-to-end) @ 100 Mbps
Key Management	Automatic KEK/DEK Exchange Using Signed Diffie-Hellman Unit Authentication Using X.509

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	Certificates
Physical Interfaces	10BaseT or 10/100BaseT Ethernet (Host and Network Ports) 10BaseT Ethernet Management Port Back and Front-Panel Serial Control Port
Device Management	THALES Element Manager, Front Panel Viewer, and Certificate Manager 10Base T (RJ-45) or 9-pin Serial Control Port SNMP Network Monitoring
Security Features	Tamper Proof Cryptographic Envelope Tamper Evident Chassis Hardware Random Number Generator
Management	Channel Encrypted Using Same Algorithm as Data Traffic
Security Certifications	FIPS 140-2 Level 3 CAPS Baseline and Enhanced Grades Common Criteria EAL4 and EAL5 (under evaluation)
Regulatory	EN60950, FCC, UL, CE, EN 50082-1, and EN 55022

M. Manufacturer:

1. Management Software Panasonic WV-ASM200.
2. Extension Software Panasonic WV-ASW201.

**2.8 RECORDING DEVICES**

- A. All cameras on the VASS System shall be recorded in real time using a Network Video Recorder (NVR), or attached storage. The type of recording device utilized should be determined by the size and type of VASS System designed and installed, and to what extent the system is to be utilized.
- B. All recording devices shall be 47.5 cm (19 inch) rack-mountable.
- C. All DVR's and NVR's that are viewable over an Intranet or Internet will be routed through an encryptor.
- D. Encryptors shall:
1. Comply with FIPS PUB 140-2.
  2. Support TCP/IP.
  3. Directly interfaces to low-cost commercial routers.
  4. Provide packet-based crypto synchronization.
  5. Encrypt source and destination IP addresses.
  6. Support web browser based management requiring no additional software.

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7. Have a high data sustained throughput – 1.544 Mbps (T1) full duplex data rate.
8. Provide for both bridging and routing network architecture support.
9. Support Electronic Key Management System (EKMS) compatible.
10. Have remote management ability.
11. Automatically reconfigure when secure network or wide area network changes.

**E. Network Video Recorder (NVR):**

1. Shall record video to a hard drive-based digital storage medium in MPEG, MPEG4 or H.264 format.
2. Shall meet the following minimum requirements:
  - a. Record at minimum rate of 30 IPS.
  - b. Have a minimum of eight (8) to 16 looping inputs.
  - c. Have a minimum of eight (8) to 16 alarm inputs and two (2) relay outputs.
  - d. Shall provide instantaneous playback of all recorded images.
  - e. Be IP addressable, if part of a VASS network.
  - f. Have built-in digital motion detection with masking and sensitivity adjustments.
  - g. Easy playback and forward/reverse search capabilities.
  - h. Complete audit trail database, with minimum of a six-month history that tracks all events related to the alarm; specifically who, what, where and when.
  - i. NVR management capability providing automatic video routing to a back-up spare recorder in case of failure.
  - j. Accessible locally and remotely via the internet, intranet, or a personal digital assistant (PDA).
  - k. Records all alarm events in real time, ensuring 60 seconds before and after the event are included in the recording.
  - l. Utilize RS-232 or fiber optic connections for integration with the SMS computer station via a remote port on a network hub.
  - m. Allow for independently adjustable frame rate settings.
  - n. Be compatible with the matrix switcher utilized to operate the cameras.

**3. Technical Characteristics:**

Hardware/CPU	Pentium III Xeon or IV, 1.8 GHz
HDD Interface	IDE or better; optional: SCSI II, SCSI Ultra,



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	or Fiber Channel
RAM	1024 MB
Operating System	Windows 2000/XP Professional/Server 2003 Standard
Graphic	Card VGA
Ethernet Card	100/1000 MB
Memory	20 MB
Software Setup	Centralized setup from each authorized PC; access via integrated web server
Storage Media	All storage media possible (e.g., HD, RAID), depending on operating system
Storage Mode	Linear mode, ring mode (capacity-based)
Recording Configuration	Camera name assignment, bandwidth limit, frame rate, video quality
Recording Content	Video and/or audio data
Search Parameters	Time, date, event
Playback	Playback via any IP network (LAN/WAN) simultaneous recording, playback, and backup
Network Interface	Ethernet (RJ-45, 10/100M)
Network Protocol	TCP/IP, DHCP, HTTP, UDP
Network Capabilities	Live/Playback/P/T/Z control
Recording Rate	30 ips for 720 x 240 (NTSC)
Password Protection	Menu Setup, Remote Access
Recording Capacity	160 (1 or 2 fixed HDD) 1 CD-RW
Power Interrupt	Auto recovered to recording mode

## **2.9 WIRES AND CABLES**

- A. Shall meet or exceed the manufactures recommendation for power and signal.
- B. Will be carried in an enclosed conduit system, utilizing electromagnetic tubing (EMT) to include the equivalent in flexible metal, rigid galvanized steel (RGS) to include the equivalent of liquid tight, polyvinylchloride (PVC) schedule 40 or 80.
- C. All conduits will be sized and installed per the NEC. All security system signal and power cables that traverse or originate in a high security office space will contained in either EMT or RGS conduit.

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- D. All conduit, pull boxes, and junction boxes shall be clearly marked with colored permanent tape or paint that will allow it to be distinguished from all other conduit and infrastructure.
- E. Conduit fills shall not exceed 50 percent unless otherwise documented.
- F. A pull string shall be pulled along and provided with signal and power cables to assist in future installations.
- G. At all locations where there is a wall penetration or core drilling is conducted to allow for conduit to be installed, fire stopping materials shall be applied to that area
- H. High voltage and signal cables shall not share the same conduit and shall be kept separate up to the point of connection. High voltage for the security system shall be defined as any cable or sets of cables carrying 30 VDC/VAC or higher.
- I. For all equipment that is carrying digital data between the Physical Access Control System and Database Management or at a remote monitoring station, shall not be less than 20 AWG and stranded copper wire for each conductor. The cable or each individual conductor within the cable shall have a shield that provides 100% coverage. Cables with a single overall shield shall have a tinned copper shield drain wire.
- J. All cables and conductors, except fiber optic cables, that act as a control, communication, or signal lines shall include surge protection. Surge protection shall be furnished at the equipment end and additional triple electrode gas surge protectors rated for the application on each wire line circuit shall be installed within 1 m. (3 ft.) of the building cable entrance. The inputs and outputs shall be tested in both normal and common mode using the following wave forms:
  - 1. A 10 microsecond rise time by 1000 microsecond pulse width waveform with a peak voltage of 1500 volts and peak current of 60 amperes.
  - 2. An 8 microsecond rise time by 20 microsecond pulse width wave form with a peak voltage of 1000 volts and peak current of 500 amperes.
- K. The surge suppression device shall not attenuate or reduce the video or sync signal under normal conditions. Fuses and relays shall not be used as a means of surge protection.
  - 1. Signal Cables:
    - a. Signal wiring for PoE cameras depends on the distance the camera is being installed from either a hub or the server.

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- b. If the camera is up to 300 ft from a hub or the server, then use a shielded UTP category 5 (CAT-V) cable with standard RJ-45 connector at each end. The cable will comply with the Power over Ethernet, IEEE802.3af, Standard.
- c. If the camera is over 300 ft from a hub or server then utilize a multimode fiber optic cable with a minimum size of 62 microns.
- d. Provide a separate cable for power.
- e. CAT-6 Technical Characteristics:

Number of Pairs	4
Total Number of Conductors	8
AWG	24
Stranding	Solid
Conductor Material	BC - Bare Copper
Insulation Material	PO - Polyolefin
Overall Nominal Diameter	.230 in.
IEC Specification	11801 Category 6
TIA/EIA Specification	568-B.2 Category 6
Max. Capacitance Unbalance	(pF/100 m) 150 pF/100 m
Nom. Velocity of Propagation	70 %
Max. Delay	(ns/100 m) 538 @ 100MHz
Max. Delay Skew	(ns/100m) 45 ns/100 m
Max. Conductor DC Resistance	9.38 Ohms/100
Max. DCR Unbalance@ 20°C	3 %
Max. Operating Voltage	UL 300 V RMS

10. Fiber Optic Cables Technical Characteristics:

Fiber Type	62.5 Micron
Number of Fibers	4
Core Diameter	2.5 +/- 2.5 microns
Core Non-Circularity	5% Maximum
Clad Diameter	125 +/- 2 microns
Clad Non-Circularity	1% Maximum
Core-clad Offset	1.5 Microns Maximum
Primary Coating Material	Acrylate
Primary Coating Diameter	245 +/- 10 microns
Secondary Coating Material	Engineering Thermoplastic

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Secondary Coating Diameter	900 +/- 50 microns
Strength Member Material	Aramid Yarn
Outer Jacket Material	PVC
Outer Jacket Color	Orange
Overall Diameter	.200 in.
Numerical Aperture	.275
Maximum Gigabit Ethernet	300 meters
Maximum Gigabit Ethernet	550 meters

**11. Power Cables:**

- a. Will be sized accordingly and shall comply with the NEC. High voltage power cables will be a minimum of three conductors, 14 AWG, stranded, and coated with a non-conductive polyvinylchloride (PVC) jacket. Low voltage cables will be a minimum of 18 AWG, stranded and non-conductive polyvinylchloride (PVC) jacket.
- b. Will be utilized for all components of the VASS System that require either a 110 VAC 60 Hz or 220 VAC 50 Hz input. Each feed will be connected to a dedicated circuit breaker at a power panel that is primarily for the security system.
- c. All equipment connected to AC power shall be protected from surges. Equipment protection shall withstand surge test waveforms described in IEEE C62.41. Fuses shall not be used as a means of surge protection.
- d. Shall be rated for either 110 or 220 VAC, 50 or 60 Hz, and shall comply with VA Master Spec 26 05 21 Low Voltage Electrical Power Conductors and Cables (600 Volts and Below).
- e. Low Voltage Power Cables
  - 1) Shall be a minimum of 18 AWG, Stranded and have a polyvinylchloride outer jacket.
  - 2) Cable size shall be determined using a basic voltage over distance calculation and shall comply with the NEC's requirements for low voltage cables.

**PART 3 - EXECUTION**

**3.1. GENERAL**

- A. Installation: The Contractor shall install all system components including VAMC furnished equipment, and appurtenances in accordance with the manufacturer's instructions, ANSI C2 and as shown, and shall

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furnish all necessary connectors, terminators, interconnections, services, and adjustments required for a complete and operable data transmission system.

- B. Identification and Labeling: The Contractor shall supply permanent identification labels for each cable at each end that will appear on the as-built drawings. The labeling format shall be identified and a complete record shall be provided to the Resident Engineer with the final documentation. Each cable shall be identified by type or signal being carried and termination points. The labels shall be printed on letter size label sheets that are self-laminated vinyl that can be printed from a computer data base or spread sheet. The labels shall be E-Z code WES12112 or equivalent.
1. The Contractor shall provide all personnel, equipment, instrumentation, and supplies necessary to perform all testing.
- C. Transient Voltage Surge Suppressors (TVSS): The Contractor shall mount TVSS within 3 m (118 in) of equipment to be protected inside terminal cabinets or suitable NEMA 1 enclosures. Terminate off-premise conductors on input side of device. Connect the output side of the device to the equipment to be protected. Connect ground lug to a low impedance earth ground (less than 10 ohms) via Number 12 AWG insulated, stranded copper conductor.
- D. Contractor's Field Test: The Contractor shall verify the complete operation of the data transmission system during the Contractor's Field Testing. Field test shall include a bit error rate test. The Contractor shall perform the test by sending a minimum of 1,000,000 bits of data on each DTM circuit and measuring the bit error rate. The bit error rate shall not be greater than one (1) bit out of each 100,000 bits sent for each dial-up DTM circuit, and one (1) bit out of 1,000,000 bits sent for each leased or private DTM circuit. The Contractor shall submit a report containing results of the field test.
- E. Acceptance Test and Endurance Test: The wire line data transmission system shall be tested as a part of the completed IDS and EECS during the Acceptance test and Endurance Test as specified.
- F. Identification and Labeling: The Contractor shall supply identification tags or labels for each cable. Cable shall be labeled at both end points and at intermediate hand holes, manholes, and junction boxes. The labeling format shall be identified and a complete

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record shall be provided to the Resident Engineer with the final documentation. Each cable shall be identified with type of signal being carried and termination points.

**3.2 INSTALLATION**

- A. System installation shall be in accordance with NECA 303, manufacturer and related documents and references, for each type of security subsystem designed, engineered and installed.
- B. Components shall be configured with appropriate "service points" to pinpoint system trouble in less than 30 minutes.
- C. The Contractor shall install all system components including Government furnished equipment, and appurtenances in accordance with the manufacturer's instructions, documentation listed in Sections 1.5 of this document, and shall furnish all necessary connectors, terminators, interconnections, services, and adjustments required for a complete and operable system.
- D. The VASS System will be designed, engineered, installed, and tested to ensure all components are fully compatible as a system and can be integrated with all associated security subsystems, whether the system is a standalone or a complete network.
- E. For integration purposes, the VASS System shall be integrated where appropriate with the following associated security subsystems:
  - 1. PACS:
    - a. Provide 24 hour coverage of all emergency exits utilizing a fixed color camera.
    - b. Record cameras on a 24 hours basis.
    - c. Be programmed go into an alarm state when an emergency exit is opened, and notify the Physical Access Control System and Database Management of an alarm event.
  - 2. IDS:
    - a. Provide a recorded alarm event via a color camera that is connected to the IDS system by either direct hardwire or a security system computer network.
    - b. Record cameras on a 24 hours basis.
    - c. Be programmed to go into an alarm state when an IDS device is put into an alarm state, and notify the PACS.
    - d. For additional VASS System requirements as they relate to the IDS, refer to Section 28 16 00 "INTRUSION DETECTION".

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3. Security Access Detection:
  - a. Record cameras on a 24 hours basis.
4. EPPS:
  - a. Provide a recorded alarm event via a color camera that is connected to the EPPS system by either direct hardwire or a security system computer network.
  - b. Record cameras on a 24 hours basis.
  - c. Be programmed to go into an alarm state when an emergency call box or duress alarm/panic device is activated, and notify the Physical Access Control System and Database Management of an alarm event.
- F. Integration with these security subsystems shall be achieved by computer programming or the direct hardwiring of the systems.
- G. For programming purposes refer to the manufacturers requirements for correct system operations. Ensure computers being utilized for system integration meet or exceed the minimum system requirements outlined on the systems software packages.
- H. A complete VASS System shall be comprised of, but not limited to, the following components:
  1. Cameras
  2. Lenses
  3. Video Display Equipment
  4. Camera Housings and Mounts
  5. Controlling Equipment
  6. Recording Devices
  7. Wiring and Cables
- I. The Contractor shall visit the site and verify that site conditions are in agreement/compliance with the design package. The Contractor shall report all changes to the site or conditions that will affect performance of the system to the Contracting Officer in the form of a report. The Contractor shall not take any corrective action without written permission received from the Contracting Officer.
- J. Existing Equipment:
  1. The Contractor shall connect to and utilize existing video equipment, video and control signal transmission lines, and devices as outlined in the design package. Video equipment and signal lines

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- that are usable in their original configuration without modification may be reused with Contracting Officer approval.
2. The Contractor shall perform a field survey, including testing and inspection of all existing video equipment and signal lines intended to be incorporated into the VASS System, and furnish a report to the Contracting Officer as part of the site survey report. For those items considered nonfunctioning, provide (with the report) specification sheets, or written functional requirements to support the findings and the estimated cost to correct the deficiency. As part of the report, the Contractor shall include a schedule for connection to all existing equipment.
  3. The Contractor shall make written requests and obtain approval prior to disconnecting any signal lines and equipment, and creating equipment downtime. Such work shall proceed only after receiving Contracting Officer approval of these requests. If any device fails after the Contractor has commenced work on that device, signal or control line, the Contractor shall diagnose the failure and perform any necessary corrections to the equipment.
  4. The Contractor shall be held responsible for repair costs due to Contractor negligence, abuse, or incorrect installation of equipment.
  5. The Contracting Officer shall be provided a full list of all equipment that is to be removed or replaced by the Contractor, to include description and serial/manufacturer numbers where possible. The Contractor shall dispose of all equipment that has been removed or replaced based upon approval of the Contracting Officer after reviewing the equipment removal list. In all areas where equipment is removed or replaced the Contractor shall repair those areas to match the current existing conditions.
- K. Enclosure Penetrations: All enclosure penetrations shall be from the bottom of the enclosure unless the system design requires penetrations from other directions. Penetrations of interior enclosures involving transitions of conduit from interior to exterior, and all penetrations on exterior enclosures shall be sealed with rubber silicone sealant to preclude the entry of water and will comply with VA Master Specification 07 84 00, FIRESTOPPING. The conduit riser shall terminate in a hot-dipped galvanized metal cable terminator. The terminator shall



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be filled with an approved sealant as recommended by the cable manufacturer and in such a manner that the cable is not damaged.

- L. Cold Galvanizing: All field welds and brazing on factory galvanized boxes, enclosures, and conduits shall be coated with a cold galvanized paint containing at least 95 percent zinc by weight.
- M. Interconnection of Console Video Equipment: The Contractor shall connect signal paths between video equipment as specified by the OEM. Cables shall be as short as practicable for each signal path without causing strain at the connectors. Rack mounted equipment on slide mounts shall have cables of sufficient length to allow full extension of the slide rails from the rack.
- N. Cameras:
  - 1. Install the cameras with the focal length lens as indicated for each zone.
  - 2. Connect power and signal lines to the camera.
  - 3. Aim camera to give field of view as needed to cover the alarm zone.
  - 4. Aim fixed mounted cameras installed outdoors facing the rising or setting sun sufficiently below the horizon to preclude the camera looking directly at the sun.
  - 5. Focus the lens to give a sharp picture (to include checking for day and night focus and image quality) over the entire field of view
  - 6. Synchronize all cameras so the picture does not roll on the monitor when cameras are selected.
- O. Monitors:
  - 1. Install the monitors as shown and specified in design and construction documents.
  - 2. Connect all signal inputs and outputs as shown and specified.
  - 3. Terminate video input signals as required.
  - 4. Connect the monitor to AC power.
- P. Video Server:
  - 1. Install the video server per design and construction documents, and as specified by the OEM.
  - 2. Connect video server to AC power (UPS).
  - 3. Connect to VASS network.
  - 4. Upgrade operating system, Video Management Software and extension software.

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5. Provide Video Management Software programming per VA guidance and the requirements provided by the Resident Engineer. Programming shall include:
  - a. Camera names
  - b. Screen views
  - c. Camera recording schedules (continuous and event) driven recording. Events include alarms from other systems (sensors), manual input, and video motion detection.
  - d. Video detection zones for each camera requiring video motion detection
  - e. Alarm interface
  - f. Alarm outputs
  - g. GUI maps, views, icons and actions
  - h. PTZ controls (presets, time schedules for privacy zones etc.)
  - i. Reports

**Q. Video Workstation:**

1. Install the video workstation per design and construction documents, and as specified by the OEM.
2. Connect video workstation to AC power (UPS).
3. Connect to VASS network.
4. Install operating system and application software.
5. Provide application software programming per VA guidance and the requirements provided by the Resident Engineer. Programming shall include:
  - a. Screen views
  - b. Graphical User Interface (GUI) maps, views, icons and actions
  - c. Alarm outputs
  - d. Reports

**R. Network Switch:**

1. Install the network switch per design and construction documents, and as specified by the OEM.
2. Connect network switch to AC power (UPS).
3. Connect network cameras to network switch.
4. Configure the network switch per manufacturer's recommendation and project requirements.

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**S. Network Recording Equipment**

1. Install the NVR or video storage unit as shown in the design and construction documents, and as specified by the OEM.
2. Connect recording device to AC power (UPS).
3. Connect recording device to network switch as shown and specified.
4. Configure network connections
5. Provide recording unit programming per VA guidance and the requirements provided by the Resident Engineer. Programming shall include:
  - a. Camera names
  - b. Screen views
  - c. Camera recording schedules (continuous and event) driven recording. Events include alarms from other systems (sensors), manual input, and video motion detection.
  - d. Video detection zones for each camera requiring video motion detection
  - e. Alarm interface
  - f. Alarm outputs
  - g. GUI maps, views, icons and actions
  - h. PTZ controls (presets, time schedules for privacy zones etc.)
  - i. Reports

**T. Video Recording Equipment:**

1. Install the video recording equipment as shown in the design and construction documents, and as specified by the OEM.
2. Connect video signal inputs and outputs as shown and specified.
3. Connect alarm signal inputs and outputs as shown and specified.
4. Connect video recording equipment to AC power.
5. Program the video recording equipment;
  - a. Recording schedules
  - b. Camera caption

**U. Video Signal Equipment:**

1. Install the video signal equipment as shown in the design and construction documents, and as specified by the OEM.
2. Connect video or signal inputs and outputs as shown and specified.
3. Terminate video inputs as required.
4. Connect alarm signal inputs and outputs as required.
5. Connect control signal inputs and outputs as required

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6. Connect electrically powered equipment to AC power.

V. Camera Housings, Mounts, and Poles:

1. Install the camera housings and mounts as specified by the manufacturer and as shown, provide mounting hardware sized appropriately to secure each camera, housing and mount with maximum wind and ice loading encountered at the site.

**3.3 SYSTEM START-UP**

- A. The Contractor shall not apply power to the VASS System until the following items have been completed:
  1. VASS System equipment items and have been set up in accordance with manufacturer's instructions.
  2. A visual inspection of the VASS System has been conducted to ensure that defective equipment items have not been installed and that there are no loose connections.
  3. System wiring has been tested and verified as correctly connected as indicated.
  4. All system grounding and transient protection systems have been verified as installed and connected as indicated.
  5. Power supplies to be connected to the VASS System have been verified as the correct voltage, phasing, and frequency as indicated.
- B. Coordinate the startup and contractor testing schedules with the Resident Engineer. Provide a minimum of 7 days prior notice.
- C. Satisfaction of the above requirements shall not relieve the Contractor of responsibility for incorrect installation, defective equipment items, or collateral damage as a result of Contractor work efforts.

**3.4 SUPPLEMENTAL CONTRACTOR QUALITY CONTROL**

- A. The Contractor shall provide the services of technical representatives who are familiar with all components and installation procedures of the installed VASS System; and are approved by the Contracting Officer.
- B. The Contractor will be present on the job site during the preparatory and initial phases of quality control to provide technical assistance.
- C. The Contractor shall also be available on an as needed basis to provide assistance with follow-up phases of quality control.
- D. The Contractor shall participate in the testing and validation of the system and shall provide certification that the system installed is fully operational as all construction document requirements have been fulfilled.

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**3.5 DEMONSTRATION AND TRAINING**

- A. All testing and training shall be compliant with the VA General Requirements, Section 01 00 00, "GENERAL REQUIREMENTS".
- B. Provide services of manufacturer's technical representative for four hours to instruct VA personnel in operation and maintenance of units.
- C. Submit training plans and instructor qualifications in accordance with the requirements of Section 28 08 00, "COMMISSIONING OF ELECTRONIC SAFETY AND SECURITY SYSTEMS".

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SECTION 28 26 00  
ELECTRONIC PERSONAL PROTECTION SYSTEM

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Provide and install complete Duress-Panic Alarms, Systems, data transmission wiring and a control station with its associated equipment, hereafter referred to as EPPS System.
- B. EPPS shall be integrated with monitoring and control system specified in Division 28 Section VIDEO SURVEILLANCE SYSTEMS PHYSICAL ACCESS CONTROL SYSTEM that specifies systems integration.

1.2 RELATED WORK

- A. Section 01 00 00 - GENERAL REQUIREMENTS. For General Requirements.
- B. Section 07 84 00 - FIRESTOPPING. Requirements for firestopping application and use.
- C. Section 10 14 00 - SIGNAGE. Requirements for labeling and signs.
- D. Section 26 05 11 - REQUIREMENTS FOR ELECTRICAL INSTALLATIONS. Requirements for connection of high voltage.
- E. Section 26 05 21 - LOW VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES (600 VOLTS AND BELOW). Requirements for power cables.
- F. Section 26 05 33 - RACEWAYS AND BOXES FOR ELECTRICAL SYSTEMS. Requirements for infrastructure.
- G. Section 28 05 00 - COMMON WORK RESULTS FOR ELECTRONIC SAFETY AND SECURITY. Requirements for general requirements that are common to more than one section in Division 28.
- H. Section 28 05 13 - CONDUCTORS AND CABLES FOR ELECTRONIC SAFETY AND SECURITY. Requirements for conductors and cables.
- I. Section 28 05 26 - GROUNDING AND BONDING FOR ELECTRONIC SAFETY AND SECURITY. Requirements for grounding of equipment.
- J. Section 28 05 28.33 - CONDUITS AND BACK BOXES FOR ELECTRONIC SAFETY AND SECURITY. Requirements for infrastructure.
- K. Section 28 13 00 - PHYSICAL ACCESS CONTROL SYSTEMS (PACS). Requirements for physical access control integration.
- L. Section 28 13 53 - SECURITY ACCESS DETECTION. Requirements for security access detection.
- M. Section 28 23 00 - VIDEO SURVEILLANCE. Requirements for security camera systems.

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**1.3 QUALITY ASSURANCE**

- A. The Contractor shall be responsible for providing, installing, and the operation of the EPPS System as shown. The Contractor shall also provide certification as required.
- B. The security system shall be installed and tested to ensure all components are fully compatible as a system and can be integrated with all associated security subsystems, whether the security system is stand-alone or a part of a complete Information Technology (IT) computer network.
- C. The Contractor or security sub-contractor shall be a licensed security Contractor as required within the state or jurisdiction of where the installation work is being conducted.
- D. Manufacturers Qualifications: The manufacturer shall regularly and presently produce, as one of the manufacturer's principal products, the equipment and material specified for this project, and shall have manufactured the item for at least three years.
- E. Product Qualification:
  - 1. Manufacturer's product shall have been in satisfactory operation, on three installations of similar size and type as this project, for approximately three years.
  - 2. The Government reserves the right to require the Contractor to submit a list of installations where the products have been in operation before approval.
- F. Contractor Qualification:
  - 1. The Contractor or security sub-contractor shall be a licensed security Contractor with a minimum of five (5) years' experience installing and servicing systems of similar scope and complexity. The Contractor shall be an authorized regional representative of the Security Management System's (PACS) manufacturer. The Contractor shall provide four (4) current references from clients with systems of similar scope and complexity which became operational in the past three (3) years. At least three (3) of the references shall be utilizing the same system components, in a similar configuration as the proposed system. The references must include a current point of contact, company or agency name, address, telephone number, complete system description, date of completion, and approximate cost of the project. The Resident Engineer reserves the option to visit the

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- reference sites, with the site Resident Engineer's permission and representative, to verify the quality of installation and the references' level of satisfaction with the system. The Contractor shall provide copies of system manufacturer certification for all technicians. The Contractor shall only utilize factory-trained technicians to install, program, and service the PACS. The Contractor shall only utilize factory-trained technicians to install, terminate and service controller/field panels and reader modules. The technicians shall have a minimum of five (5) continuous years of technical experience in electronic security systems. The Contractor shall have a local service facility. The facility shall be located within 60 miles of the project site. The local facility shall include sufficient spare parts inventory to support the service requirements associated with this contract. The facility shall also include appropriate diagnostic equipment to perform diagnostic procedures. The COTR reserves the option of surveying the company's facility to verify the service inventory and presence of a local service organization.
2. The Contractor shall provide proof project superintendent with BICSI Certified Commercial Installer Level 1, Level 2, or Technician to provide oversight of the project.
  3. Cable installer must have on staff a Registered Communication Distribution Designer (RCDD) certified by Building Industry Consulting Service International. The staff member shall provide consistent oversight of the project cabling throughout design, layout, installation, termination and testing.
- G. Service Qualifications: There shall be a permanent service organization maintained or trained by the manufacturer which will render satisfactory service to this installation within four hours of receipt of notification that service is needed. Submit name and address of service organizations.

**1.4 SUBMITALS**

- A. Submit below items in accordance with Section 28 05 00, COMMON WORK RESULTS FOR ELECTRONIC SAFETY AND SECURITY and Master Specification Sections 01 33 23, SHOP DRAWING, PRODUCT DATA, AND SAMPLES, and Section 02 41 00, DEMOLITION.
- B. Provide certificates of compliance with Section 1.3, Quality Assurance.



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- C. Provide a pre-installation and as-built design package in both electronic format and on paper, minimum size 48 x 48 inches (1220 x 1220 millimeters); drawing submittals shall be per the established project schedule.
- D. Shop drawings and as-built packages shall include, but not be limited to:
  - 1. Index Sheet that shall:
    - a. Define each page of the design package to include facility name, building name, floor, and sheet number.
    - b. Provide a list of all security abbreviations and symbols.
    - c. Reference all general notes that are utilized within the design package.
    - d. Specification and scope of work pages for all security systems that are applicable to the design package that will:
      - 1) Outline all general and job specific work required within the design package.
      - 2) Provide a device identification table outlining device Identification (ID) and use for all security systems equipment utilized in the design package.
  - 2. Drawing sheets that will be plotted on the individual floor plans or site plans shall:
    - a. Include a title block as defined above.
    - b. Define the drawings scale in both standard and metric measurements.
    - c. Provide device identification and location.
    - d. Address all signal and power conduit runs and sizes that are associated with the design of the electronic security system and other security elements (e.g., barriers, etc.).
    - e. Identify all pull box and conduit locations, sizes, and fill capacities.
    - f. Address all general and drawing specific notes for a particular drawing sheet.
  - 3. A riser drawing for each applicable security subsystem shall:
    - a. Indicate the sequence of operation.
    - b. Relationship of integrated components on one diagram.
    - c. Include the number, size, identification, and maximum lengths of interconnecting wires.

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- d. Wire/cable types shall be defined by a wire and cable schedule. The schedule shall utilize a lettering system that will correspond to the wire/cable it represents (example: A = 18 AWG/1 Pair Twisted, Unshielded). This schedule shall also provide the manufacturer's name and part number for the wire/cable being installed.
- 4. A system drawing for each applicable security system shall:
  - a. Identify how all equipment within the system, from main panel to device, shall be laid out and connected.
  - b. Provide full detail of all system components wiring from point-to-point.
  - c. Identify wire types utilized for connection, interconnection with associate security subsystems.
  - d. Show device locations that correspond to the floor plans.
  - e. All general and drawing specific notes shall be included with the system drawings.
- 5. A schedule for all of the applicable security subsystems shall be included. All schedules shall provide the following information:
  - a. Device ID.
  - b. Device Location (e.g. site, building, floor, room number, location, and description).
  - c. Mounting type (e.g. flush, wall, surface, etc.).
  - d. Power supply or circuit breaker and power panel number.
- 6. Detail and elevation drawings for all devices that define how they were installed and mounted.
- E. Pre-installation design packages shall be reviewed by the Contractor along with a VA representative to ensure all work has been clearly defined and completed. All reviews shall be conducted in accordance with the project schedule. There shall be four (4) stages to the review process:
  - 1. 35 percent
  - 2. 65 percent
  - 3. 90 percent
  - 4. 100 percent
- F. Provide manufacturer security system product cut-sheets. Submit for approval at least 30 days prior to commencement of formal testing, a Security System Operational Test Plan. Include procedures for

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operational testing of each component and security subsystem, to include performance of an integrated system test.

- G. Submit manufacture's certification of Underwriters Laboratories, Inc. (UL) listing as specified. Provide all maintenance and operating manuals per the VA General Requirements, Section 01 00 00, GENERAL REQUIREMENTS.

**1.5 APPLICABLE PUBLICATIONS**

- A. The publications listed below (including amendments, addenda, revisions, supplement, and errata) form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.
- B. American National Standards Institute (ANSI):  
ANSI S3.2-09 .....Method for measuring the Intelligibility of  
Speech over Communications Systems
- C. Department of Justice American Disability Act (ADA)  
28 CFR Part 36 .....2010 ADA Standards for Accessible Design
- D. Federal Communications Commission (FCC):  
(47 CFR 15) Part 15 ....Limitations on the Use of Wireless  
Equipment/Systems
- E. National Fire Protection Association (NFPA):  
70-11 .....National Electrical Code
- F. National Electrical Manufacturers Association (NEMA)  
250-08 .....Enclosures for Electrical Equipment (1000 Volts  
Maximum)
- G. Underwriters Laboratories, Inc. (UL):  
305-08 .....Standard for Panic Hardware  
444-08 .....Safety Communications Cables  
636-01 .....Standard for Holdup Alarm Units and Systems
- H. Uniform Federal Accessibility Standards (UFAS), 1984

**1.6 COORDINATION**

- A. Coordinate arrangement, mounting, and support of electronic safety and security equipment:
1. To allow maximum possible headroom unless specific mounting heights that reduce headroom are indicated.
  2. To provide for ease of disconnecting the equipment with minimum interference to other installations.

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3. To allow right of way for piping and conduit installed at required slope.
  4. So connecting raceways, cables, wireways, cable trays, and busways will be clear of obstructions and of the working and access space of other equipment.
- B. Coordinate installation of required supporting devices and set sleeves in cast-in-place concrete, masonry walls, and other structural components as they are constructed.
- C. Coordinate location of access panels and doors for electronic safety and security items that are behind finished surfaces or otherwise concealed.

**1.7 MAINTENANCE & SERVICE**

A. General Requirements:

1. The Contractor shall provide all services required and equipment necessary to maintain the entire integrated electronic security system in an operational state as specified for a period of one (1) year after formal written acceptance of the system. The Contractor shall provide all necessary material required for performing scheduled adjustments or other non-scheduled work. Impacts on facility operations shall be minimized when performing scheduled adjustments or other non-scheduled work. See also General Project Requirements.

B. Description of Work:

1. The adjustment and repair of the security system includes all software updates, panel firmware, and the following new items computers equipment, communications transmission equipment and data transmission media (DTM), local processors, security system sensors, facility interface, and signal transmission equipment.

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C. Personnel:

1. Service personnel shall be certified in the maintenance and repair of the selected type of equipment and qualified to accomplish all work promptly and satisfactorily. The COTR shall be advised in writing of the name of the designated service representative, and of any change in personnel. The COTR shall be provided copies of system manufacturer certification for the designated service representative.

D. Schedule of Work:

1. The work shall be performed during regular working ours, Monday through Friday, excluding federal holidays. These inspections shall include:
  - a. The Contractor shall perform two (2) minor inspections at six (6) month intervals or more if required by the manufacturer, and two (2) major inspections offset equally between the minor inspections to effect quarterly inspection of alternating magnitude.
    - 1) Minor Inspections shall include visual checks and operational tests of all console equipment, peripheral equipment, local processors, sensors, electrical and mechanical controls, and adjustments on printers.
    - 2) Major Inspections shall include all work described for Minor Inspections and the following: clean all system equipment and local processors including interior and exterior surfaces; perform diagnostics on all equipment; operational tests of the CPU, switcher, peripheral equipment, check and calibrate each sensor; run all system software diagnostics and correct all problems; and resolve any previous outstanding problems.

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**E. Emergency Service:**

1. The Resident Engineer shall initiate service calls whenever the system is not functioning properly. The Contractor shall provide the Resident Engineer with an emergency service center telephone number. The emergency service center shall be staffed 24 hours a day 365 days a year. The Resident Engineer shall have sole authority for determining catastrophic and non-catastrophic system failures within parameters stated in General Project Requirements.
  - a. For catastrophic system failures, the Contractor shall provide same day four (4) hour service response with a defect correction time not to exceed eight (8) hours from [notification] [arrival on site]. Catastrophic system failures are defined as any system failure that the Resident Engineer determines will place the facility(s) at increased risk.
  - b. For non-catastrophic failures, the Contractor within eight (8) hours with a defect correction time not to exceed 24 hours from notification.

**F. Operation:**

1. Performance of scheduled adjustments and repair shall verify operation of the system as demonstrated by the applicable portions of the performance verification test.

**G. Records & Logs:**

1. The Contractor shall maintain records and logs of each task and organize cumulative records for each component and for the complete system chronologically. A continuous log shall be submitted for all devices. The log shall contain all initial settings, calibration, repair, and programming data. Complete logs shall be maintained and available for inspection on site, demonstrating planned and systematic adjustments and repairs have been accomplished for the system.

**H. Work Request:**

1. The Contractor shall separately record each service call request, as received. The record shall include the serial number identifying the component involved, its location, date and time the call was received, specific nature of trouble, names of service personnel assigned to the task, instructions describing the action taken, the amount and nature of the materials used, and the date and time of

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commencement and completion. The Contractor shall deliver a record of the work performed within five (5) working days after the work was completed.

**I. System Modifications:**

1. The Contractor shall make any recommendations for system modification in writing to the COTR. No system modifications, including operating parameters and control settings, shall be made without prior written approval from the COTR. Any modifications made to the system shall be incorporated into the operation and maintenance manuals and other documentation affected.

**J. Software:**

1. The Contractor shall provide all software updates when approved by the Resident Engineer from the manufacturer during the installation and 12-month warranty period and verify operation of the system. These updates shall be accomplished in a timely manner, fully coordinated with the system operators, and incorporated into the operations and maintenance manuals and software documentation. There shall be at least one (1) scheduled update near the end of the first year's warranty period, at which time the Contractor shall install and validate the latest released version of the Manufacturer's software. All software changes shall be recorded in a log maintained in the unit control room. An electronic copy of the software update shall be maintained within the log. At a minimum, the contractor shall provide a description of the modification, when the modification occurred, and name and contact information of the individual performing the modification. The log shall be maintained in a white 3 ring binder and the cover marked "SOFTWARE CHANGE LOG".

**1.8 WARRANTY OF CONSTRUCTION.**

- A. Warrant EPPS System work subject to the Article "Warranty of Construction" of FAR clause 52.246-21.
- B. Demonstration and training shall be performed prior to system acceptance.

**1.9 GENERAL REQUIREMENTS**

- A. For general requirements that are common to more than one section in Division 28, refer to Section 28 05 00, COMMON WORK RESULTS FOR ELECTRONIC SAFETY AND SECURITY.

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B. General requirements applicable to this section include:

1. Performance Requirements,
2. Delivery, Handling and Storage,
3. Project Conditions,
4. Equipment and Materials,
5. Electrical Power,
6. Lightning, Power Surge Suppression, and Grounding,
7. Electronic Components,
8. Substitute Materials and Equipment, and
9. Like Items.

**PART 2 - PRODUCTS**

**2.1 EQUIPMENT AND MATERIALS**

A. General:

1. All equipment shall be rated for continuous operation.  
Environmental conditions (i.e. temperature, humidity, wind, and seismic activity) shall be taken under consideration at each facility and site location prior to installation of the equipment.
2. All equipment shall operate on a 120 or 240 volts alternating current (VAC); 50 hertz (Hz) or 60 Hz Alternating Current (AC) power system unless documented otherwise in subsequent sections listed within this spec. All equipment shall have a battery back-up source of power that will provide 12 hours (hrs.) of run time in the event of a loss of primary power to the security systems until a backup generator comes on-line.
3. The EPPS systems shall be designed, installed, and programmed in a manner that will allow for ease of operation, programming, servicing, maintenance, testing, and upgrading of the system.
4. All EPPS components located in designated "HAZARDOUS ENVIRONMENT" areas where fire or explosion could occur due to the presence of natural gases or vapors, flammable liquids, combustible residue, or ignitable fibers or debris, shall be rated Class II, Division I, Group F, and installed in accordance with National Fire Protection Association (NFPA) 70, National Electrical Code Chapter 5.
5. The Contractor shall provide the Contracting Officer with written verification, that the type of wire/cable being provided is recommended and approved by the OEM. Cabling shall meet the interconnecting wiring requirements of NFPA 70, National Electrical



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Code. The Contractor is responsible for providing the correct protection cable duct and/or conduit and wiring.

6. When interfacing with other communications or security subsystems the Contractor shall utilize interfacing methods that are approved by the Contracting Officer. At a minimum, an acceptable interfacing method requires not only a physical and mechanical connection; but also a matching of signal, voltage, and processing levels with regard to signal quality and impedance. The interface point must adhere to all standards described herein.
7. All hardwired alarms, switches, and junction boxes shall be protected from tampering and include line supervision.

**2.2 EQUIPMENT ITEMS**

- A. All systems shall be designed to provide continuous electrical supervision of the complete and entire system.
- B. Noise filters and surge protectors shall be provided for all intercommunications equipment to ensure protection from primary AC power surges and to ensure noise interference is not induced into low voltage data circuits.
- C. All alarm and initiating and signaling circuits shall be supervised for open circuits, short circuits, and system grounds. Main and Uninterrupted Power Supply (UPS) power circuits shall be supervised for any change in operating conditions (e.g. low battery, primary to back up battery, and UPS online). When an open, short or ground occurs in any system circuit, an audible and visual fault alarm signal shall be initiated at the master control station and all remote locations.
- D. Control Unit: Shall consist of the components to constantly monitor and verify alarm activation; identify zone of activation and location of activation.
- E. Audible Signal Device for Duress-Panic: Provides alarm activation and audible sound for alarms, as well as supervisory and trouble signals that shall be distinctive.
- F. Assessment: This capability shall consist of electronic devices required to visually and audibly verify the validity of alarms. Assessment also includes providing indication of tampering, fail-safe, low battery, and power losses.
- G. Alarm Monitoring and Reporting: Shall annunciate information to at least two (2) separate locations. The alarms shall maintain the

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capability to respond with local and remote visible and audible signals upon activation of an alarm. The alarms shall have the capability of operating in a silent mode, alerting personnel monitoring the system that the device has been activated.

**H. Duress-Panic Alarms:**

1. Housing shall be a rugged corrosion-resistant housing of stainless steel or Acrylonitrile Butadiene Styrene (ABS) molded plastic or similar material that is weather and dust proof.
2. Actuating device shall include a minimum of a plunger button whose head is recessed from the face/front edge of the housing and be designed to avoid accidental activation using switch guard or multiple buttons (i.e., requires pressing two (2) buttons simultaneously)
3. Alarm switch/button shall lock-in upon activation until manually reset with key or manufacture provided device.
4. The switch shall be a positive-acting, double-pole, and double-throw switch.
5. Duress/Panic alarms shall meet UL 305 Standard for Panic Alarms. To reduce the possibility of false alarms and ensure installation functionality UL 636 Standard for Holdup Alarms standards shall be met.
6. Alarms used for concealed application requires silent alarm notification to a monitoring station. They shall annunciate at the Physical Access Control System and Database Management, monitored by a central station or direct connect to local police, depending on local ordinance requirements.
7. Shall be capable of being mounted for hand or foot use in a manner that is unable to be viewed by the public. Larger systems use a computer that intercepts and processes alarms and displays them on a monitor. The central computer can make an announcement over facility hand held radios, pagers or telephones, or at the Physical Access Control System and Database Management so that the other security personnel can be immediately notified. These systems shall be hardwired.
8. Components:
  - a. Transmitter
  - b. Locator subsystem

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- c. Receiver
  - d. Software
9. Wiring will be four (4) conductor #18 American Wire Gauge (AWG).
10. Duress-Panic Alarm Technical Characteristics:

Temperature Range	0° to 110°F (-17.8°C to 43.3°C)
Nominal Voltage	12 V DC @ 6 mA
Current	Max 8 mA
Operational Voltage	7 V DC to 15 V DC
Operational life	Rated for 0,000 activations
Battery Activations	500
Actuator	Dual button plunger with activation lock
LED	Bi-color - on and activated

11. Manufacturer: United Security Products, Inc. HUB-2SA

**2.3 CONTROL PANEL**

- A. High capacity, UL Listed, control/communicator that supports up to 48 zones of protection using basic hardwired expansion zones. Ethernet uploading and downloading capability included.
- 1. IP alarm reporting and uploading/downloading capability for Internet and Intranet.
  - 2. Eight on-board hardwired zones expandable to 48 total zones when used with hardwired expansion modules.
  - 3. Two low current on-board trigger outputs.
  - 4. 100 Event Log viewable at system keypads with time/date stamp
  - 5. Communications formats supported.
    - a. ADEMCO® Contact ID.
    - b. ADEMCO 4 + 2 Express.
    - c. ADEMCO low speed.
    - d. Sescoa/Radionics.
  - 6. Reporting: 3 + 1, 4 + 1 and 4 + 2.
  - 7. Low battery reports: 11.2 - 11.6VDC.
  - 8. AC loss and restoral reporting.
  - 9. Aux. power: 12VDC, 600mA.
  - 10. Seven hour standby at 400mA aux. load with four amp hour battery.
  - 11. Output Control: four relay boards (up to 16 relays).
  - 12. Selectable response: 10msec, 350msec, 750msec.

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13. Selectable zone types: 20 plus four configurable zone types.

14. Expansion Device: 4219 - Eight hardwired zones - 16mA.

B. Manufacturer: Honeywell Security Products Americas VISTA-20PUL.

**2.4 CONTROL PANEL WIRED ZONE EXPANDER**

A. Adds 8 EOLR supervised zones connected to control/communicator via the control's console wiring.

1. 12 VDC from control's remote console connection.

2. Current: 35 mA.

B. Manufacturer: Ademco 4219.

**2.5 INSTALLATION KIT**

A. General: A kit shall be provided that, at a minimum, includes all connectors and terminals, labeling systems, barrier strips, wiring blocks or wire wrap terminals, heat shrink tubing, cable ties, solder, hangers, clamps, bolts, etc., required to accomplish a neat and secure installation. Unfinished or unlabeled wire connections will not be allowed. Contractor shall turn over to the Contracting Officer all unused and partially opened installation kit boxes, coaxial cable reels, conduit, cable tray, and/or cable duct bundles, wire rolls, and physical installation hardware. This is an acceptable alternate to the individual spare equipment requirement as long as the minimum spare items are provided in this count. The following installation sub-kits are required as a minimum:

B. System Grounding:

1. The grounding kit shall include all cable in accordance with UL 444 Communications Cables, and installation hardware required. All grounding will be according to the NEC.

2. This includes, but is not limited to:

- a. Coaxial Cable Shields
- b. Control Cable Shields
- c. Data Cable Shields
- d. Conduits
- e. Cable Duct
- f. Cable Trays
- g. Power Panels
- h. Connector Panels

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- C. Coaxial Cable: The coaxial cable kit shall include all coaxial connectors, cable tying straps, heat shrink tabbing, hangers, clamps, etc., required to accomplish a neat and secure installation.
- D. Wire And Cable: The wire and cable kit shall include all connectors and terminals, barrier straps, wiring blocks, wire wrap strips, heat shrink tubing, tie wraps, solder, hangers, clamps, labels etc., required to accomplish a neat and orderly installation.
- E. Equipment Interface: The equipment interface kit shall include any item or quantity of equipment, cable, mounting hardware and materials needed to interface Systems and Subsystems according to the OEM requirements and this specification.
- F. Labels: The labeling kit shall include any item or quantity of labels, tools, stencils, and materials needed to label each subsystem according to the OEM requirements, as-installed drawings, and this specification.
- G. Documentation: The documentation kit shall include any item or quantity of items, computer discs, as installed drawings, equipment, maintenance, and operation manuals, and OEM materials needed to correctly provide the system documentation as required by this document and explained herein.

**PART 3 - EXECUTION**

**3.1 INSTALLATION**

- A. System installation shall be installed in accordance with NFPA 731 Standards for the Installation of Electric Premises Security Systems and appropriate installation manual for each type of subsystem designed, engineered, and installed.
- B. The location and type of duress, intercom, or call-box to be installed will be in accordance with physical security requirements unique to each VA facility.
- C. For EPPS systems (i.e. use current panic/duress and emergency call boxes) that can operate through existing VA facility telephone system lines, software programming and hardware, refer to Section 27 51 23, INTERCOMMUNICATIONS AND PROGRAM SYSTEMS to integrate additional EPPS equipment.
- D. Concealed duress/panic devices shall be mounted in such a way that their location is only known by the person having knowledge of the activating device location. No wiring shall be exposed to identify the location of the activation device.

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- E. Floor mounted duress alarms shall be attached to millwork on floor. When mounted under millwork, wiring shall be routed in millwork to conduit system via flexible conduit.
- F. Hard-wired switches shall be wired to individual alarm points within the Advanced Processing Controller (apC).
- G. Wall and post mounted stations shall be mounted to meet UFAS/ADA requirements and use tamper proof bolts and screws. Testing will be finished before installation of fasteners.
- H. Cleaning: Subsequent to installation, clean each system component of dust, dirt, grease, or oil incurred during installation in accordance to manufacture instructions.
- I. Provisions shall be made for systems in high-noise areas or areas with electrical interference environments.
- J. Adjustment/Alignment/Synchronization: Contractor shall prepare for system activation by following manufacturer's recommended procedures for adjustment, alignment, or programming. Prepare each component in accordance with appropriate provisions of the component's installation, operations, and maintenance instructions.

**3.2 WIRELINE DATA TRANSMISSION**

- A. Installation: The Contractor shall install all system components including VAMC furnished equipment, and appurtenances in accordance with the manufacturer's instructions, ANSI C2 and as shown, and shall furnish all necessary connectors, terminators, interconnections, services, and adjustments required for a complete and operable data transmission system.
- B. Identification and Labeling: The Contractor shall supply permanent identification labels for each cable at each end that will appear on the as-built drawings. The labeling format shall be identified and a complete record shall be provided to the Resident Engineer with the final documentation. Each cable shall be identified by type or signal being carried and termination points. The labels shall be printed on letter size label sheets that are self laminated vinyl that can be printed from a computer data base or spread sheet. The labels shall be E-Z code WES12112 or equivalent.
- C. The Contractor shall provide all personnel, equipment, instrumentation, and supplies necessary to perform all testing.

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- D. Transient Voltage Surge Suppressors (TVSS): The Contractor shall mount TVSS within 3 m (118 in) of equipment to be protected inside terminal cabinets or suitable NEMA 1 enclosures. Terminate off-premise conductors on input side of device. Connect the output side of the device to the equipment to be protected. Connect ground lug to a low impedance earth ground (less than 10 ohms) via Number 12 AWG insulated, stranded copper conductor.
- E. Contractor's Field Test: The Contractor shall verify the complete operation of the data transmission system during the Contractor's Field Testing. Field test shall include a bit error rate test. The Contractor shall perform the test by sending a minimum of 1,000,000 bits of data on each DTM circuit and measuring the bit error rate. The bit error rate shall not be greater than one (1) bit out of each 100,000 bits sent for each dial-up DTM circuit, and one (1) bit out of 1,000,000 bits sent for each leased or private DTM circuit. The Contractor shall submit a report containing results of the field test.
- F. Acceptance Test and Endurance Test: The wire line data transmission system shall be tested as a part of the completed IDS and EECS during the Acceptance test and Endurance Test as specified.
- G. Identification and Labeling: The Contractor shall supply identification tags or labels for each cable. Cable shall be labeled at both end points and at intermediate hand holes, manholes, and junction boxes. The labeling format shall be identified and a complete record shall be provided to the Resident Engineer with the final documentation. Each cable shall be identified with type of signal being carried and termination points.

**3.3 WIRING**

- A. Wiring Method: Install cables in raceways [except in accessible indoor ceiling spaces, in attics,] [in hollow gypsum-board partitions,] and as otherwise indicated. Conceal raceways and wiring except in unfinished spaces.
- B. Wiring Method: Install cables concealed in accessible ceilings, walls, and floors where possible.
- C. Wiring within Enclosures: Bundle, lace, and train conductors to terminal points with no excess and without exceeding manufacturer's limitations on bending radii. Provide and use lacing bars and distribution spools.

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- D. Splices, Taps, and Terminations: For power and control wiring, use numbered terminal strips in junction, pull, and outlet boxes; terminal cabinets; and equipment enclosures. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.
- E. Grounding: Provide independent-signal circuit grounding recommended in writing by manufacturer.

**3.4 FIELD QUALITY CONTROL**

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect field-assembled components and equipment installation and supervise pretesting, testing, and adjusting of video surveillance equipment.
- B. Inspection: Verify that units and controls are properly installed, connected, and labeled, and that interconnecting wires and terminals are identified.
- C. Test Schedule: Schedule tests after pretesting has been successfully completed and system has been in normal functional operation for at least 14 days. Provide a minimum of 10 days' notice of test schedule.
- D. Operational Tests: Perform operational system tests to verify that system complies with Specifications. Include all modes of system operation. Test equipment for proper operation in all functional modes.
- E. Remove and replace malfunctioning items and retest as specified above.
- F. Record test results for each piece of equipment.
- G. Retest: Correct deficiencies identified by tests and observations and retest until specified requirements are met.

**3.5 ADJUSTING**

- A. Occupancy Adjustments: When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting system to suit actual occupied conditions and to optimize performance of the installed equipment. Tasks shall include, but are not limited to, the following:
  - 1. Check cable connections.
  - 2. Check proper operation of detectors.



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3. Recommend changes to walk through detectors, X-ray machines, and associated equipment to improve VAMC utilization of security access detection system.
4. Provide a written report of adjustments and recommendations.

**3.6 CLEANING**

- A. Clean installed items using methods and materials recommended in writing by manufacturer.

**3.7 DEMONSTRATION**

- A. Engage a factory-authorized service representative to train VAMC maintenance personnel to adjust, operate, and maintain electronic personal protection system (EPSS) equipment.
  1. Train VAMC maintenance personnel on procedures and schedules for troubleshooting, servicing, and maintaining equipment.
  2. Demonstrate methods of determining optimum alignment and adjustment of components and settings for system controls.
  3. Review equipment list and data in maintenance manuals.
  4. Conduct a minimum of [four] <Insert number> hours' training.

**3.8 COMMISSIONING**

- A. Provide commissioning documentation in accordance with the requirements of Section 28 08 00 - COMMISSIONING OF ELECTRONIC SAFETY AND SECURITY SYSTEMS for all inspection, start up, and contractor testing required above and required by the System Readiness Checklist provided by the Commissioning Agent.
- B. Components provided under this section of the specification will be tested as part of a larger system. Refer to Section 28 08 00 - COMMISSIONING OF ELECTRONIC SAFETY AND SECURITY SYSTEMS and related sections for contractor responsibilities for system commissioning.

**3.9 TESTS AND TRAINING**

- A. All testing and training shall be compliant with the VA General Requirements, Section 01 00 00, GENERAL REQUIREMENTS and Section 28 05 00 COMMON WORK RESULTS FOR ELECTRONIC SAFETY AND SECURITY.

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**SECTION 28 31 00  
FIRE DETECTION AND ALARM**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

- A. This section of the specifications includes the furnishing, installation, and connection of the fire alarm equipment to form a complete coordinated system ready for operation. It shall include, but not be limited to, alarm initiating devices, alarm notification appliances, control units, fire safety control devices, power supplies, and wiring as shown on the drawings and specified. The fire alarm system shall not be combined with other systems such as building automation, energy management, security, etc. this specification provides the basis for a campus type fire alarm system with buildings containing voice communications systems for a defend in place occupancy (healthcare).
- B. Fire alarm systems shall comply with requirements of the most recent VA FIRE PROTECTION DESIGN MANUAL and NFPA 72. The design, system layout, document submittal preparation, and supervision of installation and testing shall be provided by a technician that is certified NICET level III or a registered fire protection engineer. The NICET certified technician shall be on site for the supervision and testing of the system. Factory engineers from the equipment manufacturer, thoroughly familiar and knowledgeable with all equipment utilized, shall provide additional technical support at the site as required by the Resident Engineer or his authorized representative. Installers shall have a minimum of 2 years experience installing fire alarm systems.
- C. Building 1 shall have an automatic digitized voice fire alarm signal with emergency manual voice override to notify occupants to evacuate. The digitized voice message shall identify the area of the building (smoke zone) from which the alarm was initiated.
- D. Alarm signals (by device), supervisory signals (by device) and system trouble signals (by device not reporting) shall be distinctly transmitted to the main fire alarm system control unit monitored by police 24/7 and reporting to main annunciator in engineering building.

**1.2 SCOPE**

- A. Fully addressable fire alarm system on the 9th floor and 10th floor (MER Room only) of existing Building 1.

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- B. The new addressable system shall be an extension of the existing Honeywell Notifier System addressable fire alarm system recently installed.
- C. A DGP is located in the existing elevator lobby on the 9th floor core area.
- D. Basic Performance:
  - 1. Alarm and trouble signals from each building fire alarm control panel shall be digitally encoded by UL listed electronic devices onto a multiplexed communication system.
  - 2. Response time between alarm initiation (contact closure) and recording at the main fire alarm control unit (appearance on alphanumeric read out) shall not exceed 5 seconds.
  - 3. The signaling line circuits (SLC) between building fire alarm control units shall be wired Style 7 in accordance with NFPA 72. Isolation shall be provided so that no more than one building can be lost due to a short circuit fault.
  - 4. Initiating device circuits (IDC) shall be wired Style C in accordance with NFPA 72.
  - 5. Signaling line circuits (SLC) within buildings shall be wired Style 4 in accordance with NFPA 72. Individual signaling line circuits shall be limited to covering 22,500 square feet (2,090 square meters) of floor space or 3 floors whichever is less.
  - 6. Notification appliance circuits (NAC) shall be wired Style Y in accordance with NFPA 72.

**1.3 RELATED WORK**

- A. Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES. Requirements for procedures for submittals.
- B. Section 07 84 00 - FIRESTOPPING. Requirements for fire proofing wall penetrations.
- C. Section 08 71 00 - DOOR HARDWARE. For combination Closer-Holders.
- D. Section 21 13 13 - WET-PIPE SPRINKLER SYSTEMS. Requirements for sprinkler systems.
- E. Section 28 05 00 - COMMON WORK RESULTS FOR ELECTRONIC SAFETY AND SECURITY. Requirements for general requirements that are common to more than one section in Division 28.
- F. Section 28 05 13 - CONDUCTORS AND CABLES FOR ELECTRONIC SAFETY AND SECURITY. Requirements for conductors and cables.

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- G. Section 28 05 26 - GROUNDING AND BONDING FOR ELECTRONIC SAFETY AND SECURITY. Requirements for grounding of equipment.
- H. Section 28 05 28.33 - CONDUITS AND BACKBOXES FOR ELECTRONIC SAFETY AND SECURITY. Requirements for infrastructure.
- I. Section 28 05 13 - CONDUCTORS AND CABLES FOR ELECTRONIC SAFETY AND SECURITY. Requirements for conductors and cables.
- J. Section 28 08 00, COMMISSIONING OF ELECTRONIC SAFETY AND SECURITY SYSTEMS. Requirements for commissioning - systems readiness checklists, and training.
- K. Section 28 13 00, PHYSICAL ACCESS CONTROL SYSTEMS (PACS). Requirements for integration with physical access control system.

**1.4 SUBMITTALS**

- A. General: Submit 5 copies in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES, and Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS.
- B. Drawings:
  - 1. Prepare drawings using AutoCAD Release 14 software and include all contractors information. Layering shall be by VA criteria as provided by the Contracting Officer's Technical Representative (COTR). Bid drawing files on AutoCAD will be provided to the Contractor at the pre-construction meeting. The contractor shall be responsible for verifying all critical dimensions shown on the drawings provided by VA.
  - 2. Floor Plans: Provide locations of all devices (with device number at each addressable device corresponding to control unit programming), appliances, panels, equipment, junction/terminal cabinets/boxes, risers, electrical power connections, individual circuits and raceway routing, system zoning; number, size, and type of raceways and conductors in each raceway; conduit fill calculations with cross section area percent fill for each type and size of conductor and raceway. Only those devices connected and incorporated into the final system shall be on these floor plans. Do not show any removed devices on the floor plans. Show all interfaces for all fire safety functions.
  - 3. Riser Diagrams: Provide, for the entire system, the number, size and type of riser raceways and conductors in each riser raceway and number of each type device per floor and zone. Show door holder

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interface, elevator control interface, HVAC shutdown interface, fire extinguishing system interface, and all other fire safety interfaces. Show wiring Styles on the riser diagram for all circuits. Provide diagrams both on a per building and campus wide basis.

4. Detailed Wiring Diagrams: Provide for control panels, modules, power supplies, electrical power connections, auxiliary relays and annunciators showing termination identifications, size and type conductors, circuit boards, LED lamps, indicators, adjustable controls, switches, ribbon connectors, wiring harnesses, terminal strips and connectors, spare zones/circuits. Diagrams shall be drawn to a scale sufficient to show spatial relationships between components, enclosures and equipment configuration.
5. Two weeks prior to final inspection, the Contractor shall deliver to the COTR 3 sets of as-built drawings and one set of the as-built drawing computer files (using AutoCAD 2007 or later). As-built drawings (floor plans) shall show all new and/or existing conduit used for the fire alarm system.

**C. Manuals:**

1. Submit simultaneously with the shop drawings, companion copies of complete maintenance and operating manuals including technical data sheets for all items used in the system, power requirements, device wiring diagrams, dimensions, and information for ordering replacement parts.
  - a. Wiring diagrams shall have their terminals identified to facilitate installation, operation, expansion and maintenance.
  - b. Wiring diagrams shall indicate internal wiring for each item of equipment and the interconnections between the items of equipment.
  - c. Include complete listing of all software used and installation and operation instructions including the input/output matrix chart.
  - d. Provide a clear and concise description of operation that gives, in detail, the information required to properly operate, inspect, test and maintain the equipment and system. Provide all manufacturer's installation limitations including but not limited to circuit length limitations.

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- e. Complete listing of all digitized voice messages.
  - f. Provide standby battery calculations under normal operating and alarm modes. Battery calculations shall include the magnets for holding the doors open for one minute.
  - g. Include information indicating who will provide emergency service and perform post contract maintenance.
  - h. Provide a replacement parts list with current prices. Include a list of recommended spare parts, tools, and instruments for testing and maintenance purposes.
  - i. A computerized preventive maintenance schedule for all equipment. The schedule shall be provided on disk in a computer format acceptable to the VAMC and shall describe the protocol for preventive maintenance of all equipment. The schedule shall include the required times for systematic examination, adjustment and cleaning of all equipment. A print out of the schedule shall also be provided in the manual. Provide the disk in a pocket within the manual.
  - j. Furnish manuals in 3 ring loose-leaf binder or manufacturer's standard binder.
  - k. A print out for all devices proposed on each signaling line circuit with spare capacity indicated.
2. Two weeks prior to final inspection, deliver 4 copies of the final updated maintenance and operating manual to the COTR.
- a. The manual shall be updated to include any information necessitated by the maintenance and operating manual approval.
  - b. Complete "As installed" wiring and schematic diagrams shall be included that shows all items of equipment and their interconnecting wiring. Show all final terminal identifications.
  - c. Complete listing of all programming information, including all control events per device including an updated input/output matrix.
  - d. Certificate of Installation as required by NFPA 72 for each building. The certificate shall identify any variations from the National Fire Alarm Code.
  - e. Certificate from equipment manufacturer assuring compliance with all manufacturers installation requirements and satisfactory system operation.

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**D. Certifications:**

1. Together with the shop drawing submittal, submit the technician's NICET level III fire alarm certification as well as certification from the control unit manufacturer that the proposed performer of contract maintenance is an authorized representative of the major equipment manufacturer. Include in the certification the names and addresses of the proposed supervisor of installation and the proposed performer of contract maintenance. Also include the name and title of the manufacturer's representative who makes the certification.
2. Together with the shop drawing submittal, submit a certification from either the control unit manufacturer or the manufacturer of each component (e.g., smoke detector) that the components being furnished are compatible with the control unit.
3. Together with the shop drawing submittal, submit a certification from the major equipment manufacturer that the wiring and connection diagrams meet this specification, UL and NFPA 72 requirements.

**1.5 WARRANTY**

All work performed and all material and equipment furnished under this contract shall be free from defects and shall remain so for a period of one (1) year from the date of acceptance of the entire installation by the Contracting Officer.

**1.6 GUARANTY PERIOD SERVICES**

- A. Complete inspection, testing, maintenance and repair service for the fire alarm system shall be provided by a factory trained authorized representative of the manufacturer of the major equipment for a period of five (5) years from the date of acceptance of the entire installation by the Contracting Officer.
- B. Contractor shall provide all necessary test equipment, parts and labor to perform required inspection, testing, maintenance and repair.
- C. All inspection, testing, maintenance and permanent records required by NFPA 72, and recommended by the equipment manufacturer shall be provided by the contractor. Work shall include operation of sprinkler system alarm and supervisory devices. It shall include all interfaced equipment including but not limited to elevators, HVAC shutdown, and extinguishing systems.

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- D. Maintenance and testing shall be performed in accordance with NFPA 72. A computerized preventive maintenance schedule shall be provided and shall describe the protocol for preventive maintenance of equipment. The schedule shall include a systematic examination, adjustment and cleaning of all equipment.
- E. Non-included Work: Repair service shall not include the performance of any work due to improper use, accidents, or negligence for which the contractor is not responsible.
- F. Service and emergency personnel shall report to the Engineering Office or their authorized representative upon arrival at the hospital and again upon the completion of the required work. A copy of the work ticket containing a complete description of the work performed and parts replaced shall be provided to the VA Resident Engineer or his authorized representative.
- G. Emergency Service:
1. Warranty Period Service: Service other than the preventative maintenance, inspection, and testing required by NFPA 72 shall be considered emergency call-back service and covered under the warranty of the installation during the first year of the warranty period, unless the required service is a result of abuse or misuse by the Government. Written notification shall not be required for emergency warranty period service and the contractor shall respond as outlined in the following sections on Normal and Overtime Emergency Call-Back Service. Warranty period service can be required during normal or overtime emergency call-back service time periods at the discretion of the Resident Engineer or his authorized representative.
  2. Normal and overtime emergency call-back service shall consist of an on-site response within 2 hours of notification of a system trouble.
  3. Normal emergency call-back service times are between the hours of 7:30 a.m. and 4:00 p.m., Monday through Friday, exclusive of federal holidays. Service performed during all other times shall be considered to be overtime emergency call-back service. The cost of all normal emergency call-back service for years 2 through 5 shall be included in the cost of this contract.
  4. Overtime emergency call-back service shall be provided for the system when requested by the Government. The cost of the first 40



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manhours per year of overtime call-back service during years 2 through 5 of this contract shall be provided under this contract. Payment for overtime emergency call-back service in excess of the 40 man hours per year requirement will be handled through separate purchase orders. The method of calculating overtime emergency call-back hours is based on actual time spent on site and does not include travel time.

- H. The contractor shall maintain a log at each fire alarm control unit. The log shall list the date and time of all examinations and trouble calls, condition of the system, and name of the technician. Each trouble call shall be fully described, including the nature of the trouble, necessary correction performed, and parts replaced.

**1.7 APPLICABLE PUBLICATIONS**

- A. The publications listed below (including amendments, addenda, revisions, supplements and errata) form a part of this specification to the extent referenced. The publications are referenced in text by the basic designation only and the latest editions of these publications shall be applicable.
- B. National Fire Protection Association (NFPA):
- NFPA 13 .....Standard for the Installation of Sprinkler Systems, 2010 edition
- NFPA 14 .....Standard for the Installation of Standpipes and Hose Systems, 2010 edition
- NFPA 20 .....Standard for the Installation of Stationary Pumps for Fire Protection, 2010 edition
- NFPA 70.....National Electrical Code (NEC), 2010 edition
- NFPA 72.....National Fire Alarm Code, 2010 edition
- NFPA 90A.....Standard for the Installation of Air Conditioning and Ventilating Systems, 2009 edition
- NFPA 101.....Life Safety Code, 2009 edition
- C. Underwriters Laboratories, Inc. (UL): Fire Protection Equipment Directory
- D. Factory Mutual Research Corp (FM): Approval Guide, 2007-2011
- E. American National Standards Institute (ANSI):
- S3.41.....Audible Emergency Evacuation Signal, 1990 edition, reaffirmed 2008

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F. International Code Council, International Building Code (IBC), 2009 edition

**PART 2 - PRODUCTS**

**2.1 EQUIPMENT AND MATERIALS, GENERAL**

A. All equipment and components shall be new and the manufacturer's current model. All equipment shall be tested and listed by Underwriters Laboratories, Inc. or Factory Mutual Research Corporation for use as part of a fire alarm system. The authorized representative of the manufacturer of the major equipment shall certify that the installation complies with all manufacturers' requirements and that satisfactory total system operation has been achieved.

**2.2 CONDUIT, BOXES, AND WIRE**

A. Conduit shall be in accordance with Section 28 05 28.33 CONDUIT AND BACKBOXES FOR ELECTRONIC SAFETY AND SECURITY and as follows:

1. All new conduits shall be installed in accordance with NFPA 70.
2. Conduit fill shall not exceed 40 percent of interior cross sectional area.
3. All new conduits shall be 3/4 inch (19 mm) minimum.

B. Wire:

1. Wiring shall be in accordance with NEC article 760, Section 28 05 13, CONDUCTORS AND CABLES FOR ELECTRONIC SAFETY AND SECURITY, and as recommended by the manufacturer of the fire alarm system. All wires shall be color coded. Number and size of conductors shall be as recommended by the fire alarm system manufacturer, but not less than 18 AWG for initiating device circuits and 14 AWG for notification device circuits.
2. Addressable circuits and wiring used for the multiplex communication loop shall be twisted and shielded.

C. Terminal Boxes, Junction Boxes, and Cabinets:

1. Shall be galvanized steel in accordance with UL requirements.
2. All boxes shall be sized and installed in accordance with NFPA 70.
3. covers shall be repainted red in accordance with Section 09 91 00, PAINTING and shall be identified with white markings as "FA" for junction boxes and as "FIRE ALARM SYSTEM" for cabinets and terminal boxes. Lettering shall be a minimum of 3/4 inch (19 mm) high.

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4. Terminal boxes and cabinets shall have a volume 50 percent greater than required by the NFPA 70. Minimum sized wire shall be considered as 14 AWG for calculation purposes.
5. Terminal boxes and cabinets shall have identified pressure type terminal strips and shall be located at the base of each riser. Terminal strips shall be labeled as specified or as approved by the COTR.

**2.3 FIRE ALARM CONTROL UNIT**

**A. General:**

1. Building 1 shall be provided with a fire alarm control unit and shall operate as a supervised zoned fire alarm system.
2. Each power source shall be supervised from the other source for loss of power.
3. All circuits shall be monitored for integrity.
4. Visually and audibly annunciate any trouble condition including, but not limited to main power failure, grounds and system wiring derangement.
5. Transmit digital alarm information to the main fire alarm control unit.

**B. Enclosure:**

1. The control unit shall be housed in a cabinet suitable for both recessed and surface mounting. Cabinet and front shall be corrosion protected, given a rust-resistant prime coat, and manufacturer's standard finish.
2. Cabinet shall contain all necessary relays, terminals, lamps, and legend plates to provide control for the system.

**C. Power Supply:**

1. The control unit shall derive its normal power from a 120 volt, 60 Hz dedicated supply connected to the emergency power system. Standby power shall be provided by a 24 volt DC battery. The normal power shall be transformed, rectified, coordinated, and interfaced with the standby battery and charger.
2. The door holder power shall be arranged so that momentary or sustained loss of main operating power shall not cause the release of any door.
3. Power supply for smoke detectors shall be taken from the fire alarm control unit.

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4. Provide protectors to protect the fire alarm equipment from damage due to lightning or voltage and current transients.
  5. Provide new separate and direct ground lines to the outside to protect the equipment from unwanted grounds.
- D. Circuit Supervision: Each alarm initiating device circuit, signaling line circuit, and notification appliance circuit, shall be supervised against the occurrence of a break or ground fault condition in the field wiring. These conditions shall cause a trouble signal to sound in the control unit until manually silenced by an off switch.
- E. Supervisory Devices: All sprinkler system valves, standpipe control valves, post indicator valves (PIV), and main gate valves shall be supervised for off-normal position. Closing a valve shall sound a supervisory signal at the control unit until silenced by an off switch. The specific location of all closed valves shall be identified at the control unit. Valve operation shall not cause an alarm signal. Low air pressure switches and duct detectors shall be monitored as supervisory signals. The power supply to the elevator shunt trip breaker shall be monitored by the fire alarm system as a supervisory signal.
- F. Trouble Signals:
1. Arrange the trouble signals for automatic reset (non-latching).
  2. System trouble switch off and on lamps shall be visible through the control unit door.
- G. Function Switches: Provide the following switches in addition to any other switches required for the system:
1. Remote Alarm Transmission By-pass Switch: Shall prevent transmission of all signals to the main fire alarm control unit when in the "off" position. A system trouble signal shall be energized when switch is in the off position.
  2. Alarm Off Switch: Shall disconnect power to alarm notification circuits on the local building alarm system. A system trouble signal shall be activated when switch is in the off position.
  3. Trouble Silence Switch: Shall silence the trouble signal whenever the trouble silence switch is operated. This switch shall not reset the trouble signal.
  4. Reset Switch: Shall reset the system after an alarm, provided the initiating device has been reset. The system shall lock in alarm until reset.

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5. Lamp Test Switch: A test switch or other approved convenient means shall be provided to test the indicator lamps.
6. Drill Switch: Shall activate all notification devices without tripping the remote alarm transmitter. This switch is required only for general evacuation systems specified herein.
7. Door Holder By-Pass Switch: Shall prevent doors from releasing during fire alarm tests. A system trouble alarm shall be energized when switch is in the abnormal position.
8. Elevator recall By-Pass Switch: Shall prevent the elevators from recalling upon operation of any of the devices installed to perform that function. A system trouble alarm shall be energized when the switch is in the abnormal position.
9. HVAC/Smoke Damper By-Pass: Provide a means to disable HVAC fans from shutting down and/or smoke dampers from closing upon operation of an initiating device designed to interconnect with these devices.

**H. Remote Transmissions:**

1. Provide capability and equipment for transmission of alarm, supervisory and trouble signals to the main fire alarm control unit.
2. Transmitters shall be compatible with the systems and equipment they are connected to such as timing, operation and other required features.

**I. Remote Control Capability:** Each building fire alarm control unit shall be installed and programmed so that each must be reset locally after an alarm, before the main fire alarm control unit can be reset. After the local building fire alarm control unit has been reset, then the all system acknowledge, reset, silence or disabling functions can be operated by the main fire alarm control unit

**J. System Expansion:** Design the control units and enclosures so that the system can be expanded in the future (to include the addition of 20 percent more alarm initiating, alarm notification and door holder circuits) without disruption or replacement of the existing control unit and secondary power supply.

**2.4 VOICE COMMUNICATION SYSTEM (VCS)**

**A. General:**

1. An emergency voice communication system shall be installed throughout Building 1 9th Floor.

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2. Upon receipt of an alarm signal from the building fire alarm system, the VCS shall automatically transmit a pre-recorded fire alarm message throughout the floor in alarm, the floor above, and the floor below.
3. A digitized voice module shall be used to store each prerecorded message.
4. The VCS shall be arranged as a dual channel system capable of transmitting 2 different messages simultaneously.
5. The VCS shall supervise all speaker circuits, control equipment, remote audio control equipment, and amplifiers.

**B. Speaker Circuit Control Unit:**

1. The speaker circuit control unit shall include switches to manually activate or deactivate speaker circuits grouped by floor in the system.
2. Speaker circuit control switches shall provide on, off, and automatic positions and indications.
3. The speaker circuit control unit shall include visual indication of active or trouble status for each group of speaker circuits in the system.
4. A trouble indication shall be provided if a speaker circuit group is disabled.
5. A lamp test switch shall be provided to test all indicator lamps.
6. A single "all call" switch shall be provided to activate all speaker circuit groups simultaneously.
7. A voice message disconnect switch shall be provided to disconnect automatic digitized voice messages from the system. The system shall be arranged to allow manual voice messages and indicate a system trouble condition when activated.

**C. Speaker Circuit Arrangement:**

1. Speaker circuits shall be arranged such that there is one speaker circuit per smoke zone.
2. Audio amplifiers and control equipment shall be electrically supervised for normal and abnormal conditions.
3. Speaker circuits shall be either 25 VRMS or 70.7 VRMS with a minimum of 50 percent spare power available.

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4. Speaker circuits and control equipment shall be arranged such that loss of any one speaker circuit will not cause the loss of any other speaker circuit in the system.

**D. Digitized Voice Module (DVM):**

1. The Digitized Voice Module shall provide prerecorded digitized evacuation and instructional messages. The messages shall be professionally recorded and approved by the COTR prior to programming.
2. The DVM shall be configured to automatically output to the desired circuits following a 10-second slow whoop alert tone.
3. Prerecorded magnetic taped messages and tape players are not permitted.
4. The digitized message capacity shall be no less than 15 second in length.
5. The digitized message shall be transmitted 3 times.
6. The DVM shall be supervised for operational status.
7. Failure of the DVM shall result in the transmission of a constant alarm tone.
8. The DVM memory shall have a minimum 50 percent spare capacity after those messages identified in this section are recorded. Multiple DVM's may be used to obtain the required capacity.

**E. Audio Amplifiers:**

1. Audio Amplifiers shall provide a minimum of 50 Watts at either 25 or 70.7 VRMS output voltage levels.
2. Amplifiers shall be continuously supervised for operational status.
3. Amplifiers shall be configured for either single or dual channel application.
4. Each audio output circuit connection shall be configurable for Style X.
5. A minimum of 50 percent spare output capacity shall be available for each amplifier.

**F. Tone Generator(s):**

1. Tone Generator(s) shall be capable of providing a distinctive 3-pulse temporal pattern fire alarm signal as well as a slow whoop.
2. Tone Generator(s) shall be continuously supervised for operational status.

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**2.5 ALARM NOTIFICATION APPLIANCES**

**A. Speakers:**

1. Shall operate on either 25 VRMS or 70.7 VRMS with field selectable output taps from 0.5 to 2.0W and originally installed at the 1/2 watt tap. Speakers shall provide a minimum sound output of 80 dBA at 10 feet (3,000 mm) with the 1/2 watt tap.
2. Frequency response shall be a minimum of 400 HZ to 4,000 HZ.
3. Four inches (100 mm) or 8 inches (200 mm) cone type speakers ceiling mounted with white colored baffles in areas with suspended ceilings and wall mounted in areas without ceilings.

**B. Strobes:**

1. Xenon flash tube type minimum 15 candela in toilet rooms and 75 candela in all other areas with a flash rate of 1 HZ. Strobes shall be synchronized where required by the National Fire Alarm Code (NFPA 72).
2. Backplate shall be red with 1/2 inch (13 mm) permanent red letters. Lettering to read "Fire", be oriented on the wall or ceiling properly, and be visible from all viewing directions.
3. Each strobe circuit shall have a minimum of 20 percent spare capacity.
4. Strobes may be combined with the audible notification appliances specified herein.

**2.6 ALARM INITIATING DEVICES**

**A. Manual Fire Alarm Stations:**

1. Shall be non-breakglass, address reporting type.
2. Station front shall be constructed of a durable material such as cast or extruded metal or high impact plastic. Stations shall be semi-flush type.
3. Stations shall be of single action pull down type with suitable operating instructions provided on front in raised or depressed letters, and clearly labeled "FIRE."
4. Operating handles shall be constructed of a durable material. On operation, the lever shall lock in alarm position and remain so until reset. A key shall be required to gain front access for resetting, or conducting tests and drills.
5. Unless otherwise specified, all exposed parts shall be red in color and have a smooth, hard, durable finish.



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**B. Smoke Detectors:**

1. Smoke detectors shall be photoelectric type and UL listed for use with the fire alarm control unit being furnished.
2. Smoke detectors shall be addressable type complying with applicable UL Standards for system type detectors. Smoke detectors shall be installed in accordance with the manufacturer's recommendations and NFPA 72.
3. Detectors shall have an indication lamp to denote an alarm condition. Provide remote indicator lamps and identification plates where detectors are concealed from view. Locate the remote indicator lamps and identification plates flush mounted on walls so they can be observed from a normal standing position.
4. All spot type and duct type detectors installed shall be of the photoelectric type.
5. Photoelectric detectors shall be factory calibrated and readily field adjustable. The sensitivity of any photoelectric detector shall be factory set at 3.0 plus or minus 0.25 percent obscuration per foot.
6. Detectors shall provide a visual trouble indication if they drift out of sensitivity range or fail internal diagnostics. Detectors shall also provide visual indication of sensitivity level upon testing. Detectors, along with the fire alarm control units shall be UL listed for testing the sensitivity of the detectors.

**C. Heat Detectors:**

1. Heat detectors shall be of the addressable restorable rate compensated fixed-temperature spot type.
2. Detectors shall have a minimum smooth ceiling rating of 2,500 square feet (230 square meters).
3. Intermediate temperature rated (200 degrees F (93 degrees C)) heat detectors shall be utilized in all areas.

**D. Water Flow Switches:**

1. Wet pipe water flow switches for sprinkler systems shall be connected to the fire alarm system by way of an address reporting interface device.
2. All new water flow switches shall be of a single manufacturer and series and non-accumulative retard type. See Section 21 10 00, WATER

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BASED FIRE SUPPRESSION SYSTEMS for new switches added. Connect all switches shown on the approved shop drawings.

3. All new switches shall have an alarm transmission delay time that is conveniently adjustable from 0 to 60 seconds. Initial settings shall be 30-45 seconds. Timing shall be recorded and documented during testing.

**2.7 SUPERVISORY DEVICES**

**A. Duct Smoke Detectors:**

1. Duct smoke detectors shall be provided and connected by way of an address reporting interface device. Detectors shall be provided with an approved duct housing mounted exterior to the duct, and shall have perforated sampling tubes extending across the full width of the duct (wall to wall). Detector placement shall be such that there is uniform airflow in the cross section of the duct.
2. Interlocking with fans shall be provided in accordance with NFPA 90A and as specified hereinafter under Part 3.2, "TYPICAL OPERATION".
3. Provide remote indicator lamps, key test stations and identification nameplates (e.g. "DUCT SMOKE DETECTOR AHU-X") for all duct detectors. Locate key test stations in plain view on walls or ceilings so that they can be observed and operated from a normal standing position.

**B. Sprinkler System Supervisory Switches:**

1. Each sprinkler system zone control valve shall be equipped with a supervisory switch.
2. Valve supervisory switches shall be connected to the fire alarm system by way of address reporting interface device. See Section 21 10 00, WET-PIPE SPRINKLER SYSTEMS for new switches to be added. Connect tamper switches for all control valves shown on the approved shop drawings.
3. The mechanism shall be contained in a weatherproof die-cast aluminum housing that shall provide a 3/4 inch (19 mm) tapped conduit entrance and incorporate the necessary facilities for attachment to the valves.
4. The entire installed assembly shall be tamper-proof and arranged to cause a switch operation if the housing cover is removed or if the unit is removed from its mounting.

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**2.8 ADDRESS REPORTING INTERFACE DEVICE**

- A. Shall have unique addresses that reports directly to the building fire alarm panel.
- B. Shall be configurable to monitor normally open or normally closed devices for both alarm and trouble conditions.
- C. Shall have terminal designations clearly differentiating between the circuit to which they are reporting from and the device that they are monitoring.
- D. Shall be UL listed for fire alarm use and compatibility with the panel to which they are connected.
- E. Shall be mounted in weatherproof housings if mounted exterior to a building.

**2.9 SMOKE BARRIER DOOR CONTROL**

- A. Electromagnetic Door Holders:
  - 1. New Door Holders shall be standard wall mounted electromagnetic type. In locations where doors do not come in contact with the wall when in the full open position, an extension post shall be added to the door bracket.
  - 2. Operation shall be by 24 volt DC supplied from a battery located at the fire alarm control unit. Door holders shall be coordinated as to voltage, ampere drain, and voltage drop with the battery, battery charger, wiring and fire alarm system for operation as specified.
- B. A maximum of twelve door holders shall be provided for each circuit. Door holders shall be wired to allow releasing doors by smoke zone.
- C. Door holder control circuits shall be electrically supervised.
- D. Smoke detectors shall not be incorporated as an integral part of door holders.

**2.10 UTILITY LOCKS AND KEYS**

- A. All key operated test switches, control units, and lockable cabinets shall be provided with a single standardized utility lock and key.
- B. Key-operated manual fire alarm stations shall have a single standardized lock and key separate from the control equipment.
- C. All keys shall be delivered to the COTR.

**2.11 SPARE AND REPLACEMENT PARTS**

- A. Provide spare and replacement parts as follows:
  - 1. Manual pull stations - 5
  - 2. Heat detectors - 2

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3. Fire alarm strobes - 5
  4. Fire alarm speakers - 5
  5. Smoke detectors - 10
  6. Duct smoke detectors with all appurtenances - 1
  7. Sprinkler system water flow switch - 1 of each size
  8. Sprinkler valve tamper switch - 1 of each type
  9. Control equipment utility locksets - 5
  10. Control equipment keys - 10
  11. 2.5 oz containers aerosol smoke - 4
  12. Monitor modules - 3
  13. Control modules - 3
  14. Fire alarm SLC cable (same as installed) - 500 feet (152 m)
- B. Spare and replacement parts shall be in original packaging and submitted to the COTR.
- C. Furnish and install a storage cabinet of sufficient size and suitable for storing spare equipment. Doors shall include a pad locking device. Padlock to be provided by the VA. Location of cabinet to be determined by the COTR.
- D. Provide to the VA, all hardware, software, programming tools, license and documentation necessary to permanently modify the fire alarm system on site. The minimum level of modification includes addition and deletion of devices, circuits, zones and changes to system description, system operation, and digitized evacuation and instructional messages.

**2.12 INSTRUCTION CHART**

Provide typewritten instruction card mounted behind a Lexan plastic or glass cover in a stainless steel or aluminum frame with a backplate. Install the frame in a conspicuous location observable from each control unit where operations are performed. The card shall show those steps to be taken by an operator when a signal is received under all conditions, normal, alarm, supervisory, and trouble. Provide an additional copy with the binder for the input output matrix for the sequence of operation. The instructions shall be approved by the COTR before being posted.

**PART 3 - EXECUTION**

**3.1 INSTALLATION**

- A. Installation shall be in accordance with NFPA 70, 72, 90A, and 101 as shown on the drawings, and as recommended by the major equipment

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manufacturer. Fire alarm wiring shall be installed in conduit. All conduit and wire shall be installed in accordance with, Section 28 05 13 CONDUCTORS AND CABLES FOR ELECTRONIC SAFETY AND SECURITY, Section 28 05 26 GROUNDING AND BONDING FOR ELECTRONIC SAFETY AND SECURITY, Section 28 05 28.33 CONDUIT AND BACKBOXES FOR ELECTRONIC SAFETY AND SECURITY, and all penetrations of smoke and fire barriers shall be protected as required by Section 07 84 00, FIRESTOPPING.

- B. All conduits, junction boxes, conduit supports and hangers shall be concealed in finished areas and may be exposed in unfinished areas.
- C. All new and reused exposed conduits shall be painted in accordance with Section 09 91 00, PAINTING to match surrounding finished areas and red in unfinished areas.
- D. All fire detection and alarm system devices, control units and remote annunciators shall be flush mounted when located in finished areas and may be surface mounted when located in unfinished areas. Exact locations are to be approved by the COTR.
- E. Speakers shall be ceiling mounted and fully recessed in areas with suspended ceilings. Speakers shall be wall mounted and recessed in finished areas without suspended ceilings. Speakers may be surface mounted in unfinished areas.
- F. Strobes shall be flush wall mounted with the bottom of the unit located 80 inches (2,000 mm) above the floor or 6 inches (150 mm) below ceiling, whichever is lower. Locate and mount to maintain a minimum 36 inches (900 mm) clearance from side obstructions.
- G. Manual pull stations shall be installed not less than 42 inches (1,050 mm) or more than 48 inches (1,200 mm) from finished floor to bottom of device and within 60 inches (1,500 mm) of a stairway or an exit door.
- H. Where possible, locate water flow and pressure switches a minimum of 12 inches (300 mm) from a fitting that changes the direction of the flow and a minimum of 36 inches (900 mm) from a valve.
- I. Mount valve tamper switches so as not to interfere with the normal operation of the valve and adjust to operate within 2 revolutions toward the closed position of the valve control, or when the stem has moved no more than 1/5 of the distance from its normal position.
- J. Connect flow and tamper switches installed under Section 21 13 13, WET-PIPE SPRINKLER SYSTEMS.

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- K. Connect combination closer-holders installed under Section 08 71 00,  
DOOR HARDWARE.

**3.2 TYPICAL OPERATION**

- A. Activation of any manual pull station, water flow or pressure switch, heat detector, or smoke detector shall cause the following operations to occur:
1. Operate the emergency voice communication system in Building 1. For sprinkler protected buildings, flash strobes continuously only in the zone of alarm.
  2. Continuously sound a temporal pattern general alarm and flash all strobes in the building in alarm until reset at the local fire alarm control unit in Building 1.
  3. Release only the magnetic door holders in the smoke zone on the floor from which alarm was initiated after the alert signal.
  4. Transmit a separate alarm signal, via the main fire alarm control unit to the fire department.
  5. Unlock the electrically locked exit doors within the zone of alarm.
- B. Heat detectors in elevator machine rooms shall, in addition to the above functions, disconnect all power to all elevators served by that machine room after a time delay. The time delay shall be programmed within the fire alarm system programming and be equal to the time it takes for the car to travel from the highest to the lowest level, plus 10 seconds.
- C. Smoke detectors in the primary elevator lobbies of Building 1 where there is Phase I elevator recall shall, in addition to the above functions, return all elevators in the bank to the secondary floor.
- D. Smoke detectors in the remaining elevator lobbies, elevator machine room, or top of hoistway shall, in addition to the above functions, return all elevators in the bank to the primary floor.
- E. Operation of a smoke detector at a corridor door used for automatic closing shall also release only the magnetic door holders on that floor in that smoke zone.
- F. Operation of duct smoke detectors shall cause a system supervisory condition and shut down the ventilation system and close the associated smoke dampers as appropriate.
- G. Operation of any sprinkler system valve supervisory switch shall cause a system supervisory condition.

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H. Alarm verification shall not be used for smoke detectors installed for the purpose of early warning.

**3.3 TESTS**

- A. Provide the service of a NICET level III, competent, factory-trained engineer or technician authorized by the manufacturer of the fire alarm equipment to technically supervise and participate during all of the adjustments and tests for the system. Make all adjustments and tests in the presence of the COTR.
- B. When the systems have been completed and prior to the scheduling of the final inspection, furnish testing equipment and perform the following tests in the presence of the COTR. When any defects are detected, make repairs or install replacement components, and repeat the tests until such time that the complete fire alarm systems meets all contract requirements. After the system has passed the initial test and been approved by the COTR, the contractor may request a final inspection.
  - 1. Before energizing the cables and wires, check for correct connections and test for short circuits, ground faults, continuity, and insulation.
  - 2. Test the insulation on all installed cable and wiring by standard methods as recommended by the equipment manufacturer.
  - 3. Run water through all flow switches. Check time delay on water flow switches. Submit a report listing all water flow switch operations and their retard time in seconds.
  - 4. Open each alarm initiating and notification circuit to see if trouble signal actuates.
  - 5. Ground each alarm initiation and notification circuit and verify response of trouble signals.

**3.4 FINAL INSPECTION AND ACCEPTANCE**

- A. Prior to final acceptance a minimum 30 day "burn-in" period shall be provided. The purpose shall be to allow equipment to stabilize and potential installation and software problems and equipment malfunctions to be identified and corrected. During this diagnostic period, all system operations and malfunctions shall be recorded. Final acceptance will be made upon successful completion of the "burn-in" period and where the last 14 days is without a system or equipment malfunction.
- B. At the final inspection a factory trained representative of the manufacturer of the major equipment shall repeat the tests in Article

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3.3 TESTS and those required by NFPA 72. In addition the representative shall demonstrate that the systems function properly in every respect. The demonstration shall be made in the presence of a VA representative.

**3.5 INSTRUCTION**

A. The manufacturer's authorized representative shall provide instruction and training to the VA as follows:

1. Six 1-hour sessions to engineering staff, security police and central attendant personnel for simple operation of the system. Two sessions at the start of installation, 2 sessions at the completion of installation and 2 sessions 3 months after the completion of installation.
2. Four 2-hour sessions to engineering staff for detailed operation of the system. Two sessions at the completion of installation and 2 sessions 3 months after the completion of installation.
3. Three 8-hour sessions to electrical technicians for maintaining, programming, modifying, and repairing the system at the completion of installation and one 8-hour refresher session 3 months after the completion of installation.

B. The Contractor and/or the Systems Manufacturer's representative shall provide a typewritten "Sequence of Operation" including a trouble shooting guide of the entire system for submittal to the VA. The sequence of operation will be shown for each input in the system in a matrix format and provided in a loose leaf binder. When reading the sequence of operation, the reader will be able to quickly and easily determine what output will occur upon activation of any input in the system. The INPUT/OUTPUT matrix format shall be as shown in Appendix A to NFPA 72.

C. Furnish the services of a competent instructor for instructing personnel in the programming requirements necessary for system expansion. Such programming shall include addition or deletion of devices, zones, indicating circuits and printer/display text.

**PART 4 - SCHEDULES**

**4.1 SMOKE ZONE DESCRIPTIONS**

**4.2 DIGITIZED VOICE MESSAGES**

A. Digitized voice messages shall be provided for each smoke zone of the Building. The voice message shall match existing presently digitized voice message configuration within the Building.



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B. Refer to Architectural Drawings "Life Safety for Identification of  
Smoke Zones."

#### **4.3 LOCATION OF VOICE MESSAGES**

Upon receipt of an alarm signal from the building fire alarm system,  
the voice communication system shall automatically transmit a 3 second  
tone alert and a pre-recorded fire alarm message throughout.

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